The Effect of Shock Metamorphism on Zircon of the Huronian Supergroup in proximity to the Sudbury Impact, Ontario, Canada

By:

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A thesis

presented to the University of Waterloo

in fulfilment of the

thesis requirements for the degree of

Master of Science

in

Earth Sciences

Waterloo, Ontario, Canada, 2019

Author’s Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

This thesis is part of a collaboration with the Ontario Geological Survey (OGS). The OGS provided field support and guidance for sample collection. Petrographic thin sections were produced by the Vancouver GeoTech Labs and funded by the Ontario Geological Survey.

Geochemical analysis was conducted at the Geo Labs geoscience laboratories branch of the Ontario Ministry of Northern Development and Mines and were funded by the Ontario Geological Survey.

U-Pb detrital zircon geochronology samples were prepared by the author at the Jack Satterly Geochronology Laboratory at the University of Toronto and the Metal Isotope Geochemistry laboratory, Department of Earth and Environmental Sciences, University of Waterloo. Analysis was conducted at the Metal Isotope Geochemistry laboratory, Department of Earth and Environmental Sciences, University of Waterloo under the supervision of Drs. Chris Yakymchuk and Don Davis.

Abstract

U-Pb geochronology of zircon is a widely used tool, but damage to the crystal lattice of zircon and loss of Pb by impact-related shock metamorphism can affect the interpretation of U-Pb isotope data. Five samples of the Huronian Supergroup (HSG), a transitional rift to passive margin sedimentary sequence of siliciclastic rocks deposited at 2.45 – 2.22 Ga, were collected for U-Pb detrital zircon geochronology from the Matinenda, McKim, Ramsay Lake and Mississagi Formations at varying distances from the Sudbury Igneous Complex (SIC). LA-ICP-MS is used to take repeat U-Pb analyses of individual zircon at varying distances from the edge of the remnant of the SIC. A sample of the Ramsay Lake Formation sampled 4.4 km away from the outer edge of the SIC, described by Menard (2017), contains an anomalously young detrital zircon population (n=13/49) 2590 – 2480 Ma. Individual grains from this population were reanalyzed with 2-12 data points analyzed per zircon. BSE and CL images of the grains did not show any evidence of differential growth events which could cause single grains to contain different age domains. U/Pb ages for these grains could not be reproduced and had elevated discordance, errors and mean square weighted deviation (MSWD) values, consistent with Pb-loss. Some grains appear to have been partially reset by the Sudbury impact, as discordant analyses trend along a discordia line with the impact event at 1850 Ma. Therefore, the 2590 – 2480 Ma population of grains represent Pb-loss ages between their crystallization ages and the impact event. These results imply that, deformation related to the Sudbury impact has preferentially affected the grains of this population, which have suffered more Pb mobility, leading to a false young $^{207}Pb/^{206}Pb$ ages.

The 2590-2480 Ma population is compared to the main population of the same sample. Data from the main population have lower MSWD values and ages remain reproducible within error of the analytical technique. This observation demonstrates that distance from the impact is not the sole factor affecting the reaction of individual zircon to shock metamorphism because within a sample not all of the zircon suffer the same degree of uncertainty.

Samples were taken from the Elliot Lake area, approximately 90 km away from the Sudbury Igneous Complex to control for potential effects of the Sudbury impact. As expected, the overall sample discordance, uncertainty and MSWD values for the zircon from Elliot Lake is much lower, indicating that as a first order of approximation, distance is the most dominant factor affecting Pb-loss in zircon on a kilometer scale. But, within the shatter cone limit of an impact, factors other than distance also affect the percent of discordant grains within a sample and Pb-loss within zircon. Overall, the effect of the Sudbury impact is more far reaching and may have disrupted U/Pb systems much farther than previously estimated.

Acknowledgements

I would like to thank my supervisors, Drs. Shoufa Lin and Chris Yakymchuk, for their guidance, support and time dedicated to the completion of this thesis.

I would also like to thank Dr. Don Davis from Jack Satterly Geochronology Laboratory at the University of Toronto for his guidance and discussion of the U-Pb Geochronology results and their implications.

In addition, I would like to thank Dr. Michael Easton, Dr. Renée-Luce Simard and Caroline Gordon of the Ontario Geological Survey for their expertise on the local geology and assistance acquiring the samples.

Special thanks to my life partner Stéfan Sauer for your understanding and continued emotional support through this significant milestone. Thank you for supporting me when my ages weren't reproducible, and my thesis fell apart. And thank you for celebrating with me when I picked up all the pieces and rewrote the entire project.

Lastly, I would like to thank all the members of the Department of Earth and Environmental Sciences at the University of Waterloo for their friendship and support throughout the thesis.

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List of Abbreviations

He: Helium

Ar: Argon

Rb: Rubidium

Sr: Strontium

Pb: Lead

Th: Thorium

U: Uranium

BSE: Back-scatter Electron

CL: Cathodoluminescence

HSG: Huronian Supergroup

ID-TIMS: Isotope Dilution Thermal Ionization Mass Spectrometry

LA-ICP-MS: Laser Ablation Inductively Coupled Plasma Mass Spectrometry

Ma: Million years

MSWD: Mean Square Weighted Deviation

N: North

n: number / count

NAD: North American Datum

OGS: Ontario Geological Survey

PDDD: Probability Density Distribution Diagram

SEM: Scanning Electron Microscope

SIC: Sudbury Igneous Complex

UTM: Universal Transverse Mercator

1. Introduction

There are 190 confirmed bolide impact sites on Earth (Spray, 2019). These impacts have a profound impact on the target rocks due to the creation of a high energy shock wave which will propagate through the target rocks, inducing shock metamorphism of the rock and minerals (Martell, 2016; Moser, 1997). The amount of energy released by an impact is dependent on the size of the bolide and as such, the larger the meteorite, the higher the degree of damage and the larger the area affected (French, 1998). The rapid release of impact-related energy creates high-pressure deformation features in rocks and minerals at the meter to micrometer scale by the process of shock metamorphism (Wittman et al., 2006). Shock metamorphism and deformation can influence the behaviour of Pb in zircon, which has implications for determining the geological significance of U-Pb data retrieved from zircon (Timms et al., 2012).

Zircon is the most common mineral used in geochronology studies and understanding its response to high-pressure shock metamorphic conditions is paramount to the proper interpretation of the age data retrieved from these minerals (Corfu et al., 2003). Zircon is most commonly selected for use as a chronometer in the study of meteorite impacts due to its resistance to both physical and chemical weathering which allows it to resist the bulk of the damage of shock metamorphism when compared to other minerals (Martell, 2016). However, shock waves can damage the crystal lattice of zircon leaving the zircon vulnerable to post impact fluid alteration and subsequent Pb-loss (Deutsch & Scharer, 1990; Scharer & Deutsch, 1990). In addition to impact-related deformation, Pb mobility in zircon is enhanced by metamictization of the zircon, which is the result of accumulated damage to the crystal lattice by radioactive decay of U and Th and subsequent removal of mother or daughter product (Balan et al., 2001). In the case of zircon, the daughter product, lead, is preferentially lost. Zircon which have experienced shock metamorphism preserve physical evidence of the event through a unique combination of microstructures; planar fractures, curviplanar fractures, melt pseudomorphs, and microtwins (Moser et al., 2011). The presence and intensity of microstructures is closely linked to the degree of damage and Pb-loss suffered by the zircon (Krogh et al., 1996). As such, microstructures act as a physical and identifiable representation of the damage generated from the energy released by the meteorite impact (Corfu et al., 2003).

Impact related microstructures and textures are used as key indicators of shock metamorphism and subsequent Pb-loss (Corfu et al., 2003). How does the effect of shock metamorphism affect zircon with increasing proximity to the Sudbury Impact? Samples of the Huronian Supergroup (HSG) were collected at varying distance from the Sudbury Igneous Complex (SIC), the remnant of the impact melt sheet of the Sudbury impact. Individual zircon were repeatedly dated by LA-ICP-MS to determine whether zircon lacking evidence of shock metamorphism, such as planar deformation features commonly observed in shocked zircon, can still have U/Pb data compromised by a proximal meteorite impact. Samples taken at 4.4 km, 5.0 km and 6.8 km will determine the radial distance at which individual zircon suffer Pb-loss and the effect of distance on discordance within individual zircon and in the overall sample as it relates to shock metamorphism from the Sudbury impact.

In addition, this thesis will determine the origin or cause of the anomalously young detrital zircon population (n=13/49) 2590 – 2480 Ma described by Menard (2017). This population requires additional investigation because these are uncommon igneous ages in the identified sedimentary source. As well, the sample's proximity to the Sudbury Impact, makes it susceptible to shock metamorphism, Pb mobility and Pb loss. As a result, determining the origin of this population of zircon is of great interest for the geology of the region as it could either represent a different sedimentary source or be an indicator of Pb mobility and Pb loss related to the Sudbury Impact.

2. Geological Setting

2.1 Huronian Supergroup

The Huronian Supergroup (HSG) is an assemblage of greenschist- to amphibolite-facies metamorphosed siliciclastic sedimentary rocks deposited from 2.45 to 2.22 Ga with minor bimodal volcanic rocks associated with initial opening of a rift basin (Corfu & Andrews, 1986; Krogh et al., 1984). These sediments are thought to have been deposited in a transitional rift to passive continental margin basin, at the southern extent of the Superior Province (Thurston et al., 1992). The present exposure of the HSG is ca. 12 km vertical thickness in the south and thins to the north, extending from the city of Sudbury in the east to Sault Ste Marie to the west (Figure 2) (Thurston et al., 1992). The HSG is separated into four formal stratigraphic groups. From the oldest to the youngest they are: the Elliot Lake, Hough Lake, Quirke Lake and Cobalt Group (Long, 1978) (Figure 1). Apart from the Elliot Lake Group, the HSG contains a repeating depositional sequence of basal conglomerates/diamictites, siltstones/mudstones and capped by sandstones. This repeating sequence has been interpreted to begin with a glacial to paraglacial environment associated with the deposition of the diamictite/conglomeratic unit (Roscoe, 1969; Thurston et al., 1992). At the end of the glacial period, rising sea level would cause the deposition of the siltstone/mudstone unit (Roscoe, 1969). Lastly, isostatic rebound allowed the crust to return to its original position and deposit sandstone in the higher energy environment (Roscoe, 1969). Samples for this thesis were taken from the Matinenda and McKim Formations of the Elliot Lake Group and from the Ramsay Lake and Mississagi Formations of the Hough Lake Group (Figure 1).

The source of the HSG sediment has been determined using a combination of paleocurrent indicators and detrital zircon provenance data. Paleocurrent indicators are sedimentary structures that are used to estimate the direction of past flowing water. Many paleocurrent indicators are measured and their trends are analyzed to reconstruct past depositional environments. In the HSG the Mississagi Formation has been commonly selected for paleocurrent studies due to the abundance of preserved sedimentary structures such as cross-bedding. Paleocurrent data from Long (1978) taken from the Mississagi Formation indicates that the sediment which formed the HSG was sourced from the Superior Province, to the north. The paleocurrent data is supported by the provenance data of the HSG whose detrital zircon population commonly peak between 2720 Ma and 2650 Ma with zircon younger that 2640 Ma uncommon apart from minor peaks at

2450 Ma, the age of the volcanic formations at the base of the HSG. In the southern Superior Province. Zircon population peaks of 2720 Ma and 2680 Ma are characteristic of the HSG and have been interpreted to be derived from early arc volcanism and accretionary magmatism in the Superior Province (Card, 1990). Large igneous sources of zircon with ages younger than 2650 Ma are uncommon in the present exposure of the Superior Province (Card, 1990). The detrital zircon population 2590 – 2480 Ma identified by Menard (2017) are uncommon in the Superior Province. As a result, these zircon are of geologic interest as they could indicate a different source for the HSG or be the result of a local source.

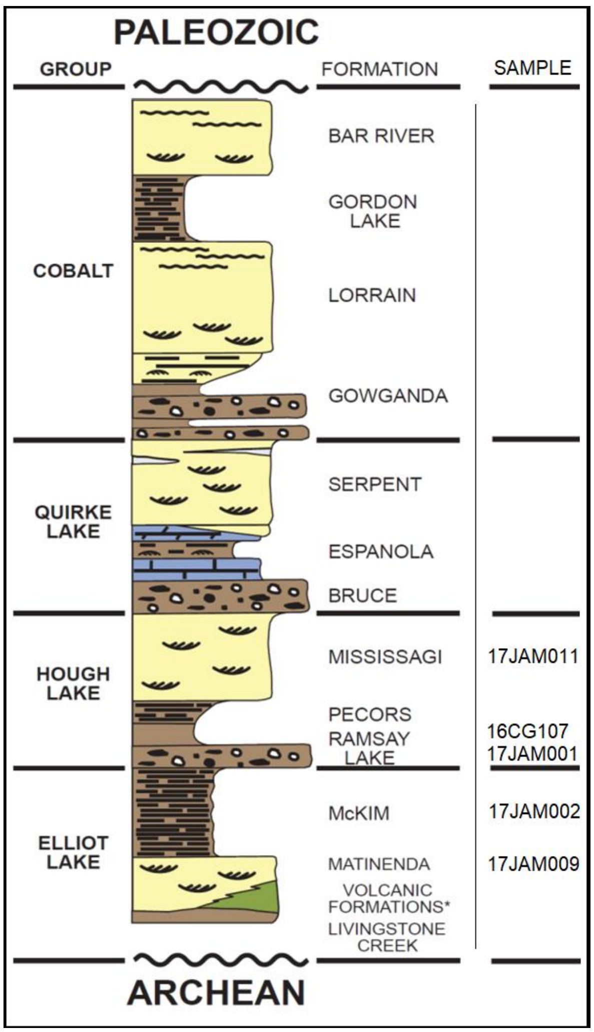


Figure 1: Stratigraphic column of the Huronian Supergroup. Figure modified from Easton and Heaman (2011).

2.2 Sudbury Structure

The Sudbury Structure is a collective term which includes the Sudbury Basin, the Sudbury Igneous Complex, the brecciated country rock and the ores associated with the impact (Rousell & Brown, 2009). The Sudbury Structure is a complex crater which has been deformed to an elliptical shape by northward folding and faulting during the Penokean orogeny (Grieve & Therriault, 2000). The Sudbury Igneous Complex (SIC) is the remnant of a large differentiated lava sheet formed by the impact of a large meteorite at 1850 ± 1 Ma dated by U/Pb of zircon from the norite component of the SIC (Krogh et al., 1984). The SIC is divided into four transitional layers with the contact sublayer at the base, followed by norite, quartz gabbro and granophyre (Therriault et al., 2002). The country rock includes the Archean rocks of the Superior Province and the Paleoproterozoic rocks of the Huronian Supergroup (Percival et al., 2006; Percival et al., 2012). The country rocks host a variety of shock metamorphic features. These features include shatter cones, pseudotachylite, quartz planar deformation features as well as other microstructures preserved in zircon (Dietz, 1964; Grieve & Therriault, 2000).

Shatter cones are cone shaped fracture network induced by intense shock waves which initiate at the base of the shatter cone (Deutsch et al., 1995). In Sudbury, shatter cones have been identified up to 17 km (Figure 2) from the outer edge of the SIC (Dietz, 1964). Shock metamorphic features in zircon from the Huronian Supergroup are present at a micron scale and can result in morphological changes in zircon texture (Krogh et al., 1996).

Due to zircon's resistance to physical and chemical alteration, it is capable of recording and preserving many features and textures. In the case of meteorite impacts, zircon have been observed to preserve textures ranging from a granular recrystallization texture at the highest preserved degree of shock metamorphism to planar deformation features at lower degrees of shock metamorphism (Corfu et al., 2003). At the highest degree of shock metamorphism in close proximity to the impact zircon can be completely reset to the age of the impact. Morphological changes and textures, in shocked zircon, have been correlated with an increase in the degree of discordance and lead loss observed in the geochronological data (Kamo et al., 1996). Zircon affected by impacts exhibit different microstructures at an increasing density depending on its distance from the impact and the intensity of the shock metamorphic conditions, leading to increased discordance of the U/Pb ages (Moser et al. 2011). However, zircon which have suffered lower degrees of shock do not suffer Pb-loss as a direct result of the shock metamorphism. These zircon are left susceptible to Pb-loss by secondary processes such as by thermally activated volume diffusion and fluid alteration based on the degree of structural damage created by the impact (Krogh et al., 1996). Discordance is related to the expression of microstructures, the intensity of which can be used to estimate shock temperature, pressure and distance from the impact (Moser et al. 2011).

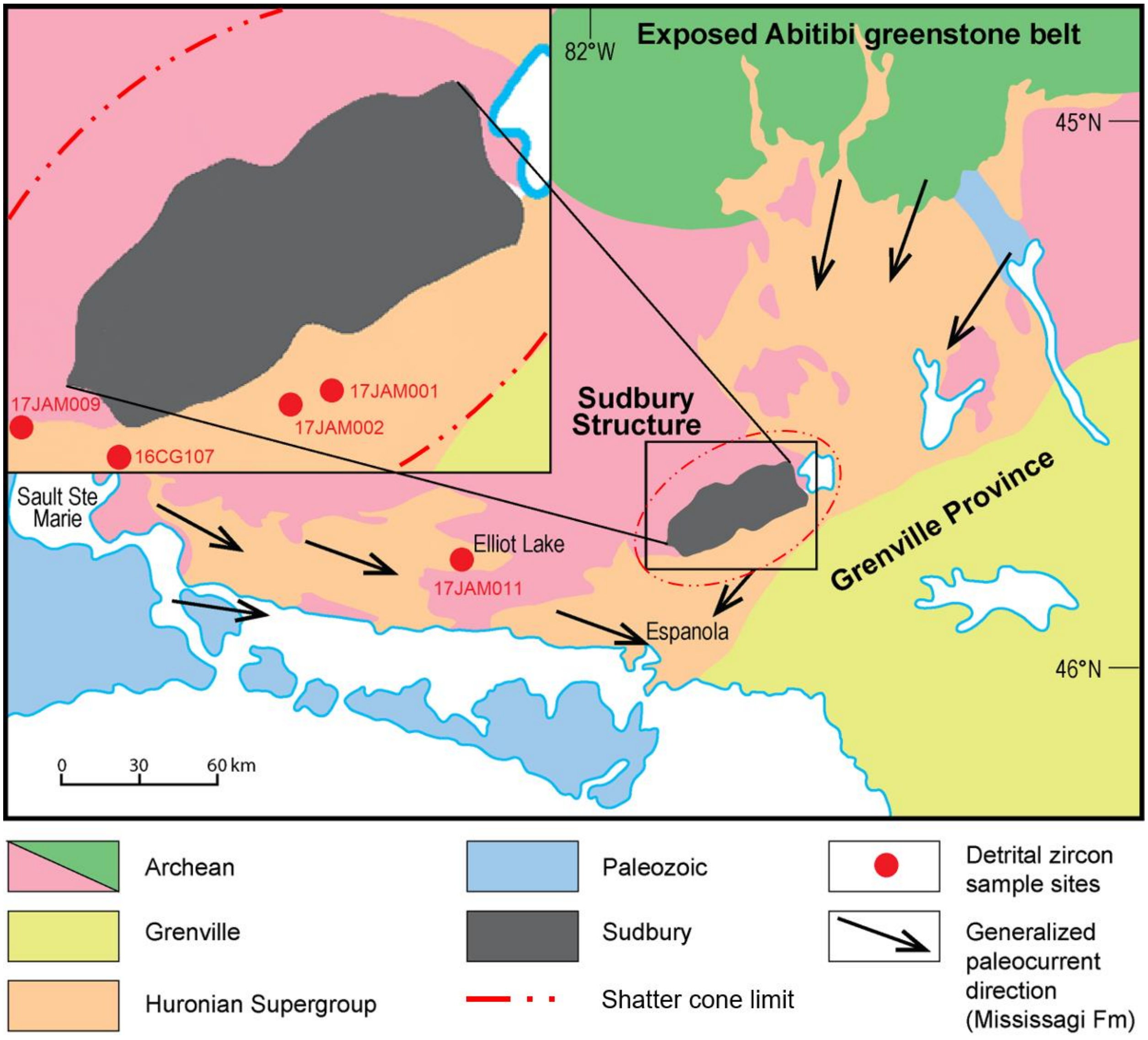


Figure 2: Simplified geological map of the Sudbury Structure showing the areal distribution of the sample locations related to this study. Sample 16CG107 was collected and initially analyzed for provenance by Menard (2017). Paleocurrent data in the Mississagi Formation is from Long (1978). Figure modified from Easton and Heaman (2011).

3. Methods

3.1 Primary Crushing and Separation

Five samples were taken in the field using a sledgehammer and the weathered surface is removed in the field leaving approximately 10 kg of fresh rock. The samples are then crushed by a chipmunk jaw crusher into chips and pulverized into < 1mm sized fragments by a disk mill pulverizer. The rock flour is passed over a Wilfley table, separating out the less dense minerals, keeping the heavy split. Iron filings from crushing and milling were removed with a magnet. The remaining heavy split is passed through a Franz magnetic separator at increasing amperage, continuing with the non-magnetic split, to remove magnetic minerals. This last non-magnetic split is passed through methyl iodine (specific gravity 3.2g/cm^3). After Franz and heavy liquid separation, sample 17JAM011 contained a large amount of pyrite (80-90%), which made picking quite difficult. Consequently, nitric acid digestion was used to dissolve the pyrite on this sample only, using 5 molar nitric acid for 30-45 minutes, stirring constantly and raising the temperature of the solution while ensuring the reaction is stable until the reaction has ceased, leaving a very clean zircon concentrate.

3.2 Zircon Picking and Mounting

Zircon were chosen based on their transparency, size, and shape, choosing primarily clear, large and euhedral grains. On average, 150 zircon were picked from each sample and mounted in 105 epoxy resin. The standard zircon were mounted along with the samples and have known ages determined by ID-TIMS; DD85-17 (3002 ± 2 Ma) (Tomlinson et al., 2003) and DD91-1 (2682.4 ± 1 Ma) (Davis, 2002). The mounts hardened over several days and were then polished by hand using finer and finer abrasive sheets, the final polish being 1 µm.

3.3 LA-ICP-MS Preparation and Analysis

The samples were analyzed using an Analyte G2 193 nm Excimer Laser coupled to an Agilent 8800 triple quadrupole ICP-MS at the University of Waterloo. Prior to the samples undergoing LA-ICP-MS, all of the grains were imaged using a JEOL JSM6610-Lv scanning electron microscope (SEM) at the University of Toronto. Backscatter (BSE) and cathodoluminescence (CL) images were taken and from these, analytical spots for U–Pb geochronology were chosen based on the least alteration and cracks. Prior to the analysis, the samples were pre-ablated with a larger diameter than the spot size with three shots to clean the surface of the grains. The following isotopes were measured, followed by dwell times: ^{88}Sr (0.01s), ^{206}Pb (0.03s), ^{207}Pb

(0.06s), ^{232}Th (0.01s) and ^{238}U (0.02s). The average gas flow is He1 0.360, He2 0.200 and Ar 1.500 L/min. The gas flow is adjusted between runs as part of tuning for the instrument. The following standard and sample pattern is used: DD85-17, DD91-1, five unknowns, DD85-17, five unknowns, DD85-17 and DD91-1. The laser is operated at 5 Hz and a fluence of 5 J/cm^2 measured at the sample surface. This fluence is chosen to ensure that the laser is properly coupled to the sample to maximize sample volatization. The laser's fluence also determines the relative depth that will be ablated, the deeper the ablation the more Pb/U will fractionate (Ver Hoeve et al., 2018). Samples were run, grain size permitting, with a spot size of 40 µm, if the grain size is smaller, a spot size of 20 µm is used. Smaller diameter areas allow for a more precise selection of the target area, which facilitates the avoidance of cracks and altered patches, but consequently increases downhole Pb/U fractionation (Ver Hoeve et al., 2018) and decreases precision. A small ablation area is essential for this study due to the small size of many of the grains, their higher degree of alteration and the frequency of cracks within the grains. When grain size permitted, a larger diameter beam size is used to reduce downhole fractionation.

3.4 Data Reduction

Data are edited and reduced using custom VBA software (UtiLAZ program) written by Don W. Davis, Associate Professor at the University of Toronto. This software is used because it can easily censor abnormal points within the data set and censor data points from altered zones. The PDDD and concordia plots are created using Isoplot (Version 3.75; Ludwig, 2012a). No downhole correction is applied because downhole fractionation of Pb vs. U is still quite small and can be corrected through the primary standard. No correction is made for common Pb which is usually insignificant, relative to radiogenic Pb, in unaltered Archean zircon (Davis and Sutcliffe, 2017; Davis et al., 2018). ^{88}Sr is monitored and its presence in zircon is related to zones of alteration and inclusions in zircon (Davis, et al., 2018). Elevated counts of ^{88}Sr have been associated with an anomaly in the U/Pb ratio and such points or plateaux were manually censored or rejected (Davis and Sutcliffe, 2017; Davis, et al., 2018).

3.5 Standard zircon

The primary standard is used to correct for factors such as mass fractionation, instrument drift during analytical sessions and as a check on the overall quality of the data (Black et al., 2004). The secondary standard is treated as an unknown sample during data processing and all corrections are applied. Similarly, to the primary standards, secondary standards are isotopically homogeneous zircon which have been precisely dated to ensure agreement on a precise age. Because the age of the secondary standard is known, and its age is reproducible across different laboratories, variation within its age can be attributed to errors with the instruments or from data processing. Before analyzing the effect of shock metamorphism on the zircon dated as part of this study, it is necessary to establish a baseline of the amount of variation within an average grain. Variations within the analysis of the same sample can be caused by the instruments and dating method. The zircon analyses plotted in Figure 4 are from DD91-1 which was used as a secondary standard. From the plot below, through our analysis, an age of 2680.8 +/-3.0 Ma is obtained with an MSWD of 1.4. This result is within uncertainty of the accepted age (2682.4 ± 1 Ma) (Davis, 2002), meaning that the methods used give an accurate age.

Standard zircon are necessary to ensure the reproducibility of a given result. If a result cannot be reproduced, the results and conclusions drawn from it may not be representative of the phenomenon being measured, making interpreting the data more difficult. It is important to choose a standard similar in age and Uranium concentration to the unknown to correct for mass fractionation (Black et al., 2004). Standards demonstrate the analytical limits of instruments and analytical techniques allowing the identification of outliers resulting from geologic processes by ruling out errors caused by the instrument.

3.6 Imaging

It is standard practice to image zircon selected for geochronological study using a scanning electron microscope, most commonly by backscatter electron and cathodoluminescence. Through these images, chemical zones can be identified, which is necessary for targeting of zones within the zircon for further analysis. Damaged or altered portions of the zircon are avoided to improve the reliability and ensure that the U/Pb data is as precise as possible. Damaged and altered portions of zircon are more likely to have lost radiometric daughter product, increasing the uncertainty within the data set. Within SEM images these damaged or altered zones are identified by microstructures such as fractures or different colours, shades or zoning around a feature or microstructure often found in association with fractures. Images have their limitations, as an image is only representative of the top few microns of the surface. The LA-ICP-MS dating technique typically excavates 15-20 microns into the zircon through different zones or damaged portions of the grain which may not be visible on the BSE and CL images. BSE and CL images are powerful and necessary tools when identifying targets for further geochronologic study, but on their own, cannot identify all potential sources of isotope variation within a grain.

3.7 Assumptions of Geochronology

Zircon selected for dating in a geochronological study should also have reproducible ages (Black et al., 2004). A key assumption of geochronology is that the material being dated has not experienced a loss or gain of mother (U) or daughter product (Pb) and has, therefore remained a closed system (Wetherill, 1963). When a zircon is no longer a closed system, the age calculated from it can either be dating the event which caused the open system behavior, or a mixed age between the original crystallization age and the Pb-loss event. If all of the daughter product it lost, the zircon is considered reset by the event and will express the age of the event. If some of the daughter product remains the age will fall on a mixing line or discordia line between the crystallization age and the event. Therefore, it is helpful for the researcher to have a good understanding of the history of the sample and which geologic events could have affected the integrity of the zircon. Geologic events which can cause open system behavior include hydrothermal fluids, metamorphism and meteorite impacts.

3.8 $^{207}Pb/^{206}Pb$ Ages

Pb-Pb ages are used for all the samples of this study. $^{207}Pb/^{206}Pb$ ages were chosen because chemical processes such as fluid alteration do not change the ratio of the two Pb isotopes (Corfu et al., 2013). Both isotopes of Pb will be removed from the zircon in equal proportions (Corfu et al., 2013). In the case of U/Pb ages, Pb is preferentially lost from the zircon, making U/Pb ages appear younger. The older the zircon, the more likely it is to have altered U/Pb ratios affected by tectonic and extraterrestrial processes. Consequently, $^{207}Pb/^{206}Pb$ ratios and ages are more resilient to Pb-loss and preferred for Archean aged zircon.

4. Sample Description

Five samples of the Huronian Supergroup were collected for U-Pb zircon geochronology at varying distances from the SIC (Figure 1, Figure 2 & Table 1). Samples were taken from the Matinenda, McKim, Ramsay Lake and Mississagi Formations (Figure 1 & Table 1). It is essential to recognize that the present-day distances of samples from the SIC may not be equivalent to the distance of the sample at the time of impact because of the repeated folding and faulting of these rocks after the impact (Shanks & Schwerdtner, 1990).

Table 1: Sample description and location coordinates in UTM NAD83 Zone 17N.

Sample	Formation	Rock Type	km from SIC	Easting	Northing
16CG107	Ramsay Lake	Conglomeratic Sandstone	4.4	465844	5137013
17JAM001	Ramsay Lake	Conglomeratic Sandstone	6.8	497322	5144924
17JAM002	McKim	Fine grain Sandstone	5.0	493464	5144352
17JAM009	Matinenda	Sandstone	7.5	457868	5140950
17JAM011	Mississagi	Sandstone	93.3	371708	5140408

For all samples, the selected zircon varied from 300 to 40 um in length and from euhedral to round in shape (Figure 3). The colour of the zircon differs depending on the area from which they were sampled. Due to the variable provenance of the zircon, there is also a lot of variation in the colour, shape and size of the zircon (Figure 3). The images from Figure 3C and 3D is representative of the surfaces of grains and show numerous fractures that are also visible in polished sections.

All samples have been metamorphosed to greenschist facies which is characterized by the replacement of biotite to chlorite in thin section (Figure 3E). The south range of the SIC has been more strongly deformed by orogenic events after the emplacement of the SIC as is evidenced by the many faults, folds and shear zones which cross cut the SIC (Rousell & Brown, 2009).

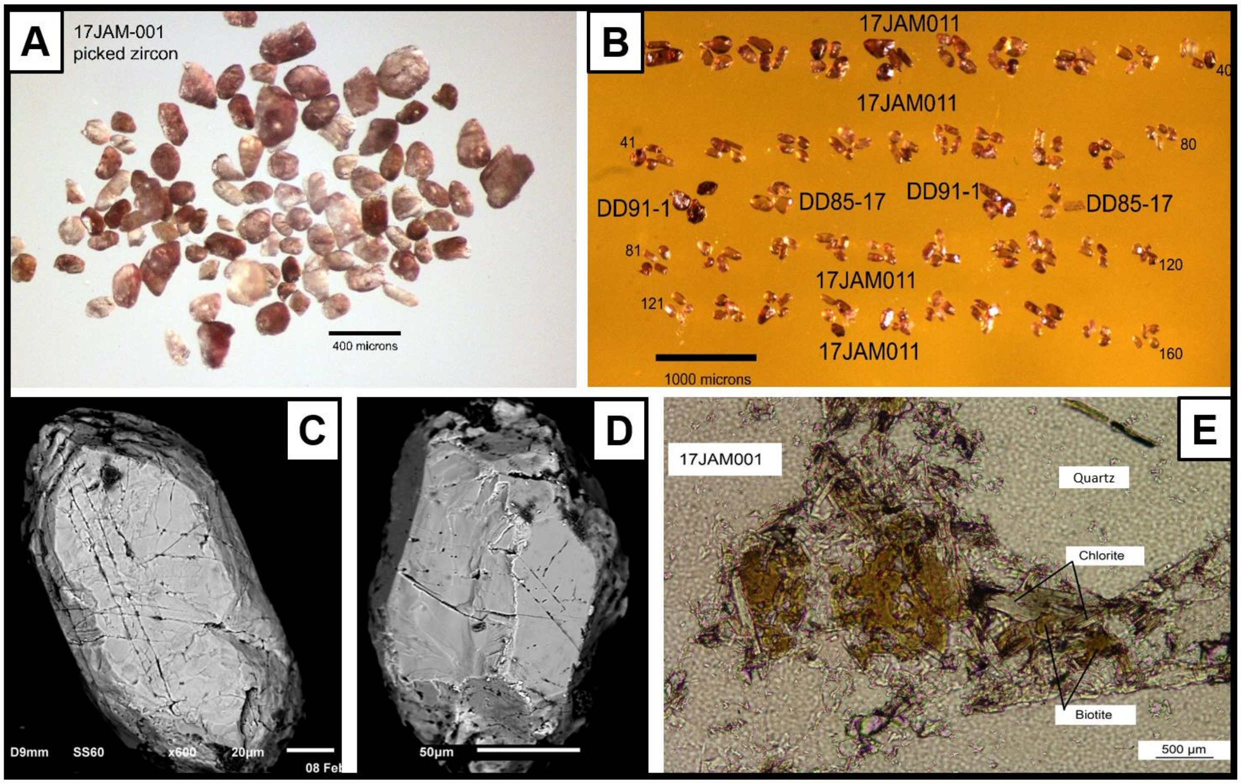


Figure 3: Summary of the physical characteristics of the zircon from various samples. (A) Picked zircon of sample 17JAM001 (6.8 km from the edge of the Sudbury Igneous Complex). (B) Mounted zircon population of sample 17JAM011 (93.3 km from the edge of the Sudbury Igneous Complex near Elliot Lake). (C and D) Backscatter electron images of the surface of grains from sample 17JAM009 of the Matinenda Formation from Drury Township (7.5 km from the edge of the Sudbury Igneous Complex). (E) Plain Polarized Light image of chlorite and biotite in sample 17JAM001 supporting a greenschist-facies metamorphism.

5. Results

5.1 Secondary Standard

The secondary standard used is sample DD91-1. It is a relatively high uranium standard (approx. 300ppm) from the Lac Fournière pluton, a quartz diorite pluton that crosscuts the Pontiac metasedimentary rocks near their northern margin with the Abitibi belt with a standard age of 2682.4 ± 1.0 Ma determined by ID-TIMS (Davis, 2002). As an example, standard DD91-1 obtained an age of 2680.8 ±3.0 Ma with an MSWD of 1.4 (n=15) for one (Figure 4). This result is within error of the accepted age, meaning that our data is inferred to be accurate. The mean square weighted deviation (MSWD) is a common statistic used as a goodness of fit test between a model and a data set (Spencer et al., 2017). A MSWD value can be subdivided into two components: MSWD of concordance and MSWD of equivalence. A MSWD of concordance is a measure of how well an analysis plots relative to concordia. A MSWD of equivalence is a measure of how well individual analysis plot relative to each other. The total MSWD includes both the MSWD of concordance and equivalence (Ludwig, 2012b). A MSWD value of one indicates that the observed values and their uncertainties define a univariant population whose scatter is explained by the analytical uncertainties (Spencer et al., 2017). If the value of the MSWD is <1 then the uncertainties within the data set vary less than what is predicted by the analytical uncertainties (Spencer et al., 2017). If the value of the MSWD is >1 then there is more uncertainty in the data set than what is predicted by the analytical uncertainties (Spencer et al., 2017). If the MSWD is much greater than one then it is likely that an outside factor or process is introducing uncertainty into the data set (Spencer et al., 2017).

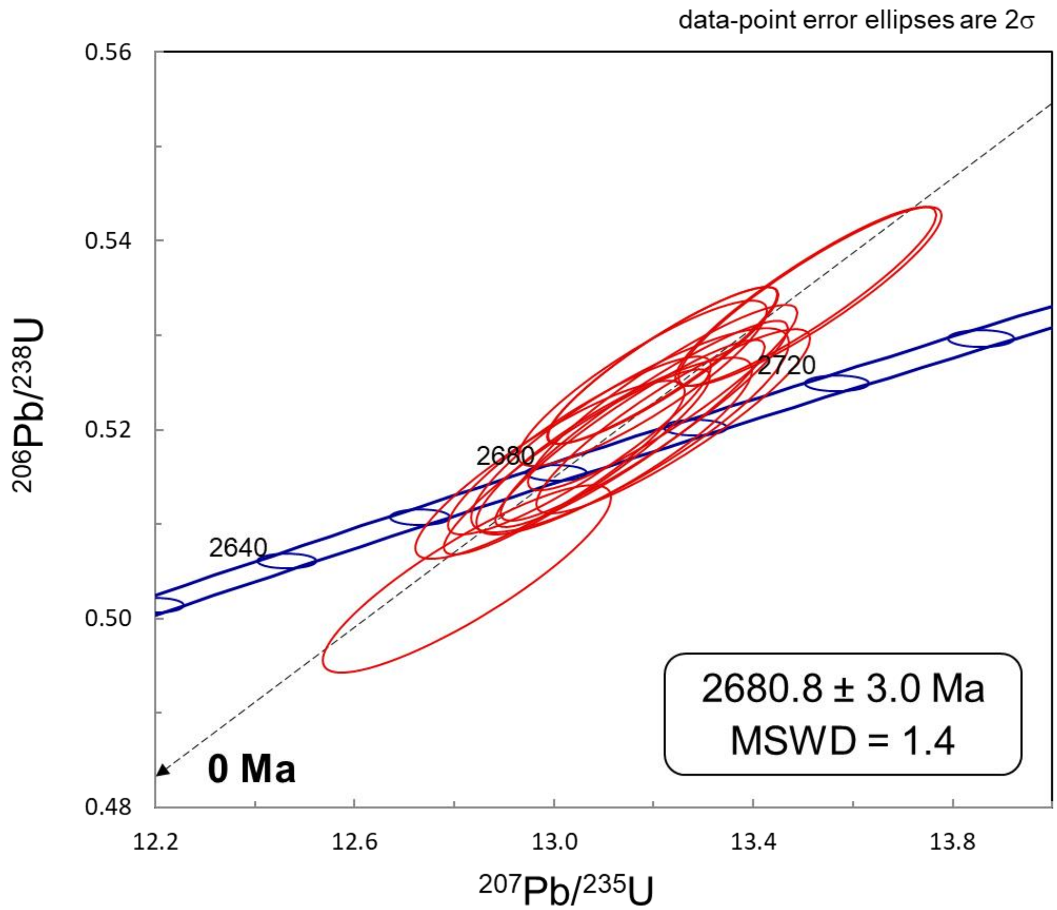


Figure 4: Wetherill Concordia Diagram of Standard DD91-1(n=15). The concordia age of this standard is 2680.8 ± 3.0 Ma. The concordia plot was created using Isoplot (Version 3.75; Ludwig, 2012a).

5.2 Sample 16CG107

This sample is from the Ramsay Lake Formation and was collected off Fairbanks Lake Road within the Totten Mine Footprint on (Table 1). This sample is approximately 4.4 km from the edge of the Sudbury Igneous Complex in Drury Township, Sudbury, Ontario, Canada. This sample was collected and analyzed by Menard (2017) (Figure 1 and 2). The zircon range from transparent and clear to foggy and brown to opaque brown (Figure 3A). From sample 16CG107, 49 grains were analyzed for U–Pb geochronology. 34 grains have a discordance value above 5% (illustrated in blue in Figure 5). The remaining grains have a discordance value below 5% (illustrated in green in Figure 5). Of the concordant analyses, the main population of zircon yield a peak of ~2660 Ma with secondary peaks at ~2635 Ma and ~2710 Ma. Overall, 87% of the concordant analyses are between 2630 Ma and 2670 Ma (Figure 5).

The original provenance data for sample 16CG107 had been previously collected and analyzed by Menard (2017). The repeat analyses of single grains from this sample were analyzed as part of this thesis. From the original provenance study, a population of 13/49 (26.5%) zircon had $^{207}Pb/^{206}Pb$ ages of 2590-2480 Ma (Menard, 2017). All 13 zircon from this population were re-analyzed using the same LA-ICP-MS technique described in the methodology.

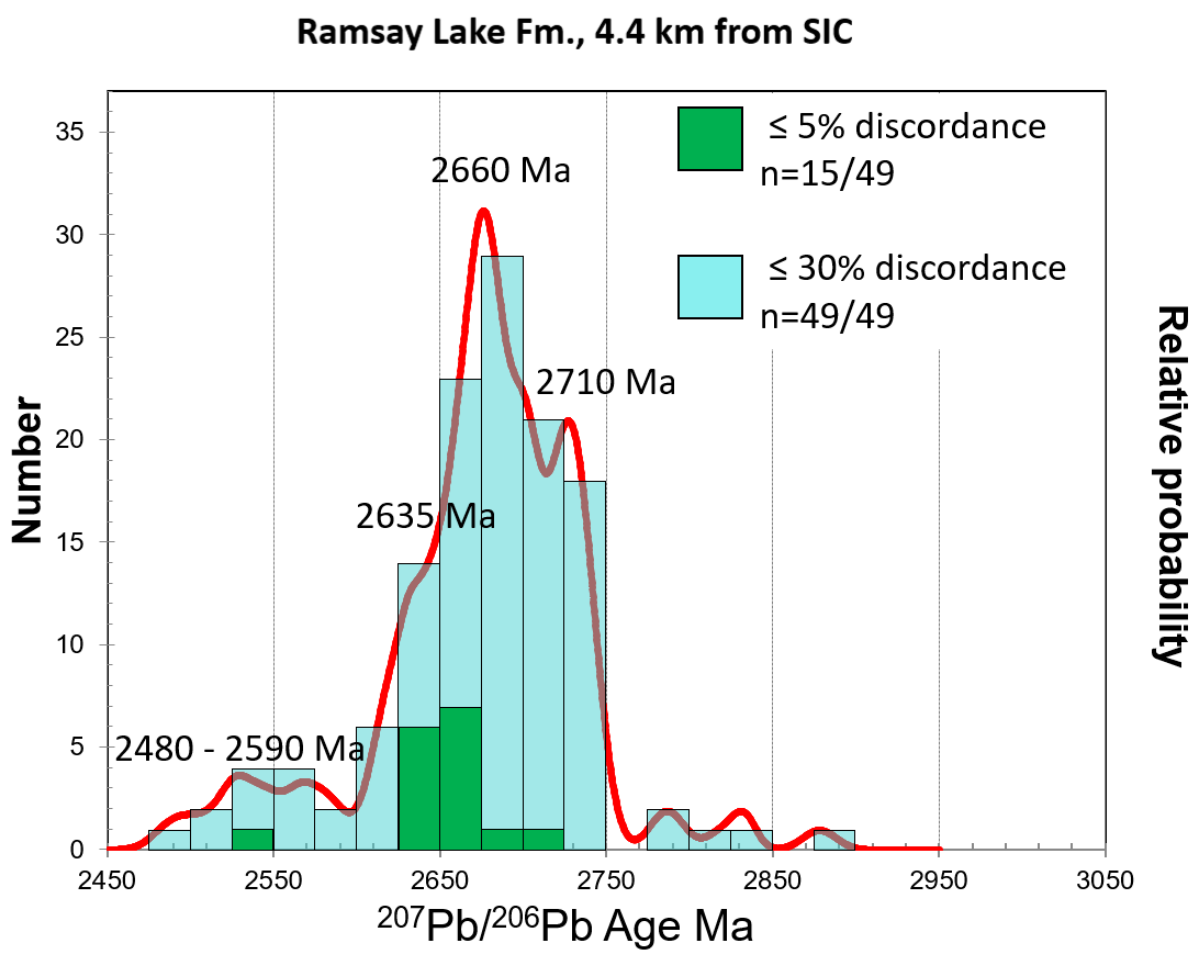
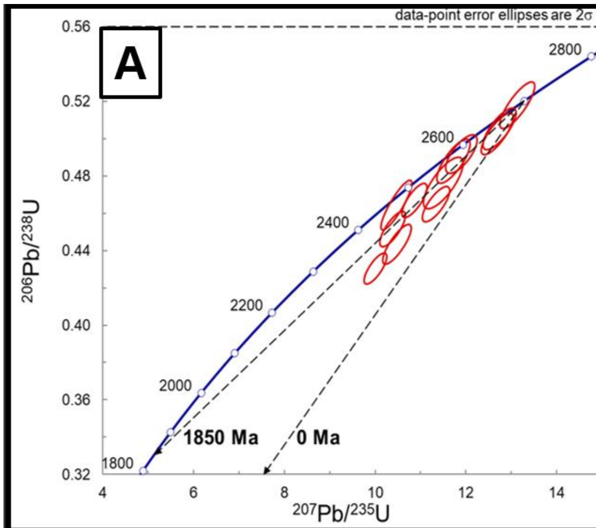


Figure 5: Probability Density Distribution Diagram of sample 16CG107 from the Ramsay Lake Formation, 4.4 km from the outer edge of the Sudbury Igneous Complex. Zircon with a discordance 30% > 5% are labelled in blue and zircon with ≤ 5% discordance are labelled in green. The PDDD was created using Isoplot (Version 3.75; Ludwig, 2012a).

The $^{207}Pb/^{206}Pb$ ages, for an example zircon reanalyzed as part of this study, range from 2688-2493 Ma and together yield a weighted mean age of 2678 ± 72 Ma (n=12) with an MSWD of 30

(Figure 6). Therefore, this data is inconsistent with a single crystallization age and is consistent with Pb-loss and open system behaviour. When using LA-ICP-MS as the analytical technique, the uncertainty limit is 1.0% at 2 sigma for U-Th-Pb geochronology using a high U and Pb reference material (Horstwood et al., 2016). Using a 1.0% as the limit of uncertainty accounted for by the analytical technique, 11/13 zircon from the 2590 – 2480 Ma zircon population have uncertainties greater than 1.0%, meaning that there is a geologic phenomenon causing excess uncertainty in the data.

The discordia lines in Figure 6A are anchored at an estimated crystallization age of 2700 Ma, based on the data of the table in Figure 6, and define the component of Pb-loss which can be attributed to each mechanism of Pb-loss. Analyses which plot closer to the 1850 Ma discordia line can be attributed to a greater component of Pb-loss to partial Pb-loss resulting from the Sudbury impact at 1850 Ma (Figure 6) whereas analyses which plot below the 1850 Ma discordia line, can be attributed to a greater component of their Pb-loss to protracted Pb-loss to the present (Figure 6). The 1850 Ma discordia line lies just below the concordia line, making it difficult for concordant and discordant grains to be distinguished with a single analysis point, especially when considering their uncertainties. If we use 5% as a maximum allowable discordance within this study, three different analysis clusters are within analytical uncertainty of concordia. This cluster of analysis points have $^{207}Pb/^{206}Pb$ ages of approximately 2680, 2600 and 2500 Ma (Figure 6). These clusters do not resemble typical crystallization and growth band zoning, which are absent from the BSE and CL images (Figure 6B and 6C). These differences in observed $^{207}Pb/^{206}Pb$ ages are not the result of alteration because the response from the BSE and CL images are consistent and do not exhibit blotchy, uneven or mottled zoning (Figure 6B and 6C)(Corfu et al., 2003).



Analysis	^{207}Pb/^{206}Pb Age Ma	%Discordance
16CG107-11.12	2493	2
16CG107-11.10	2526	6
16CG107-11.1	2544	11
16CG107-11.11	2545	4
16CG107-11.6	2572	10
16CG107-11.9	2599	2
16CG107-11.8	2607	4
16CG107-11.7	2611	2
16CG107-11.5	2625	7
16CG107-11.3	2679	2
16CG107-11.4	2681	3
16CG107-11.2	2688	0

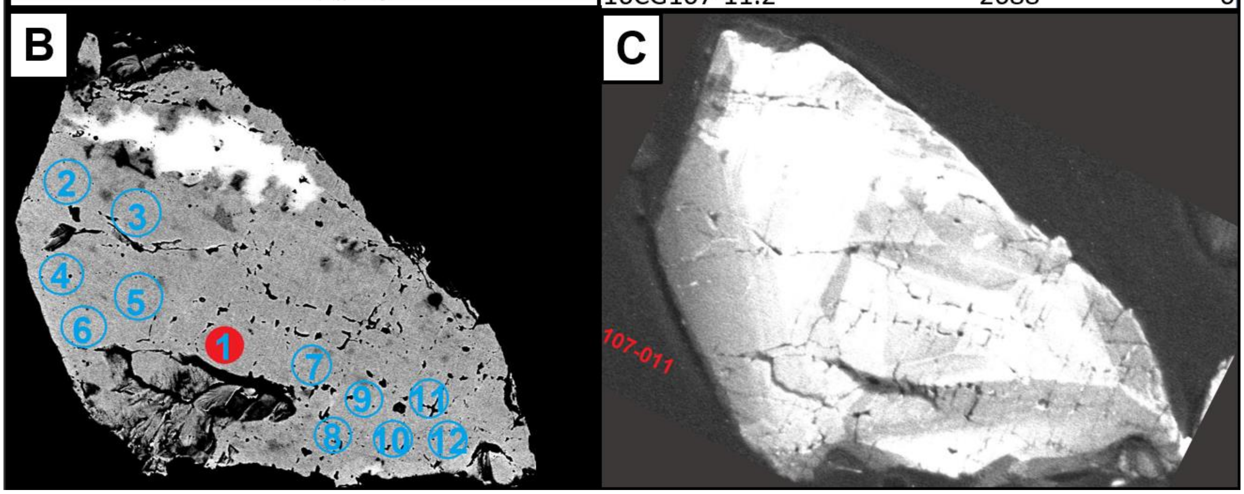


Figure 6: Summary diagram of grain #11 from sample 16CG107 Ramsay Lake Formation in Drury Township, 4.4 km from the Sudbury Igneous Complex. (A) Wetherill concordia diagram created using Isoplot (Version 3.75; Ludwig, 2012a) with discordia lines anchored at an estimated crystallization age of 2700 Ma projected to 1850 Ma and 0 Ma, demonstrating the effect of partial lead loss as a result of the Sudbury impact and of protracted lead loss to the present. The table summarizes the ages and associated discordance values of the repeat analyses of grain #11 of sample 16CG107, plotted on the Wetherill concordia diagram. (B) Backscatter electron image of grain #11 along with the locations of the repeat analyses detailed in the table. (C) Cathodoluminescence image of the grain, illustrating the different domains and internal variations of the zircon.

5.3 Sample 17JAM002

This sample is from the McKim Formation off regional road 55 (Table 1). This sample is approximately 5.0 km from the edge of the Sudbury Igneous Complex in McKim Township, Sudbury, Ontario, Canada (Figure 1 and 2). The zircon collected from the McKim Formation have a smaller grain size, which limits the number of spots that can be analyzed from individual zircon. The zircon range from transparent and clear to cloudy and brown to opaque brown (Figure 3A).

For the sample, 102 grains were analyzed for U–Pb geochronology, 36 grains of which have a discordance value above 5%. The main population of zircon with concordant $^{207}Pb/^{206}Pb$ ages for this sample yield a peak of ~2635 Ma with secondary peaks at ~2665 Ma and ~2705 Ma, 70% of the grains peak between 2630 Ma and 2700 Ma (Figure 7A). For the repeat analyses of a single zircon, the $^{207}Pb/^{206}Pb$ ages range from 2659-2438 Ma (n=4) and together yield a weighted mean age of 2675 ± 130 Ma with an MSWD of 12. Therefore, assuming the zircon is a single-age crystal, these data are inconsistent with a single crystallization age because the MSWD is well above 1 (Figure 7B). The repeat analyses from this single zircon plot closer to the discordia line with 1850 Ma (Figure 7C).

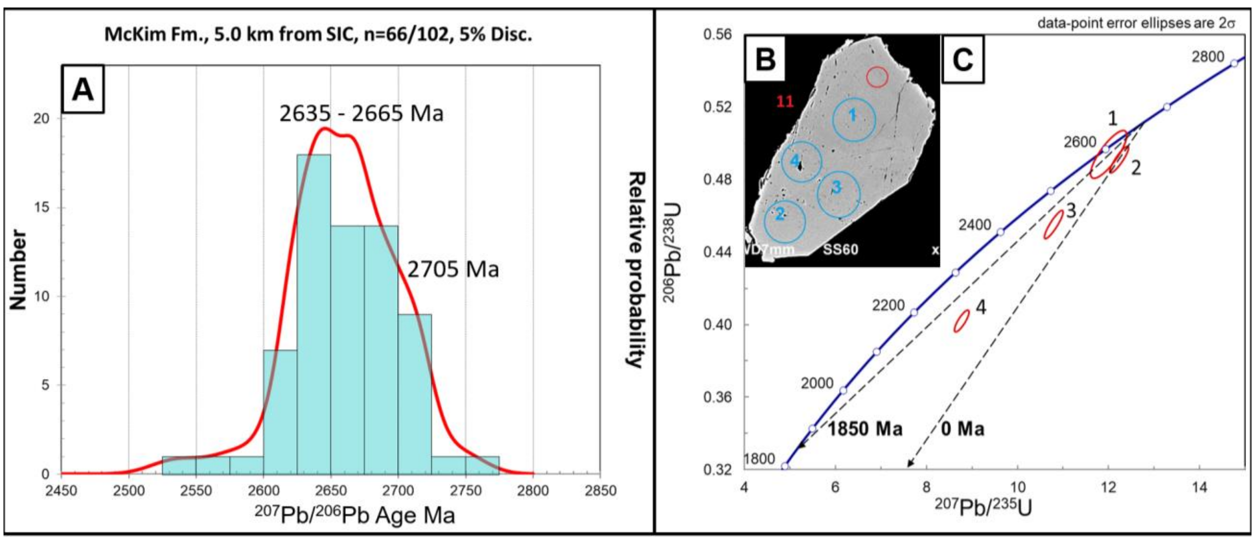


Figure 7: Summary diagram of sample 17JAM002 of the McKim Formation from McKim township, 5.0 km from the Sudbury Igneous Complex. (A) Probability Density Distribution Diagram for the sample, the data plotted is ≤ 5% discordant. (B) Backscatter electron image of grain #11 from sample 17JAM002 whose repeat analyses are labelled in the concordia diagram. (C) Wetherill concordia diagram of grain #11 with discordia lines anchored at an estimated crystallization age of 2680 Ma projected to 1850 Ma and 0 Ma, demonstrating the effect of partial lead loss as a result of the Sudbury impact and of protracted lead loss to the present. The PDDD and concordia plot are created using Isoplot (Version 3.75; Ludwig, 2012a).

5.4 Sample 17JAM001

This sample is from the Ramsay Lake Formation and was collected off Southview Drive (Table1). This sample is approximately 6.8 km from the edge of the Sudbury Igneous Complex in McKim Township, Sudbury, Ontario, Canada (Figure 1 and 2). The zircon range from transparent and clear to foggy and brown to opaque brown (Figure 3A).

For the sample, 120 grains were analyzed for U–Pb geochronology, 39 of which have a discordance value above 5%. The main population of zircon with concordant $^{207}Pb/^{206}Pb$ ages for this sample yield a peak of ~2660 Ma with secondary peaks at ~2725 Ma and ~2840 Ma, 65% of the grains is within the main peak (Figure 8A). An example zircon of which repeat analyses were taken is shown in Figure 8C. The $^{207}Pb/^{206}Pb$ ages of zircon range from 2680 to 2662 Ma and yield a weighted mean age of 2665.3 ± 4.0 Ma (n=7) with an MSWD of 1.9 (Figure 8C). The repeat analyses of this zircon is consistent with a single crystallization age and is inconsistent with Pb-loss because all the individual analyses are concordant with a low uncertainty and MSWD (Spencer et al. 2017). Error for the repeat analyses of a single grain is below the analytical limit of 1% (Horstwood et al. 2016) and is similar to the baseline established by the secondary standard (Figure 4). Theses indicate that the repeat analyses for this zircon, illustrated in Figure 8, demonstrate analytical reproducibility. The small uncertainty of the weighted mean age and the low MSWD, indicate that this zircon has remained a closed system with respect to Pb despite its proximity to the SIC. Within this sample there are other grains which have higher discordance. Of all the grains that are redated in this sample, none exceed the uncertainty threshold of 1.0% (Horstwood et al., 2016). This zircon is collected 6.8 km from the SIC, but unlike the zircon from Figure 5 (4.4 km) & Figure 6 (5.0 km), repeat analyses on this grain yielded reproducible $^{207}Pb/^{206}Pb$ ages, despite the many visible fractures. These observations indicate that proximity to the SIC and the presence of fractures alone can't fully predict the discordance present in all the samples collected in this study.

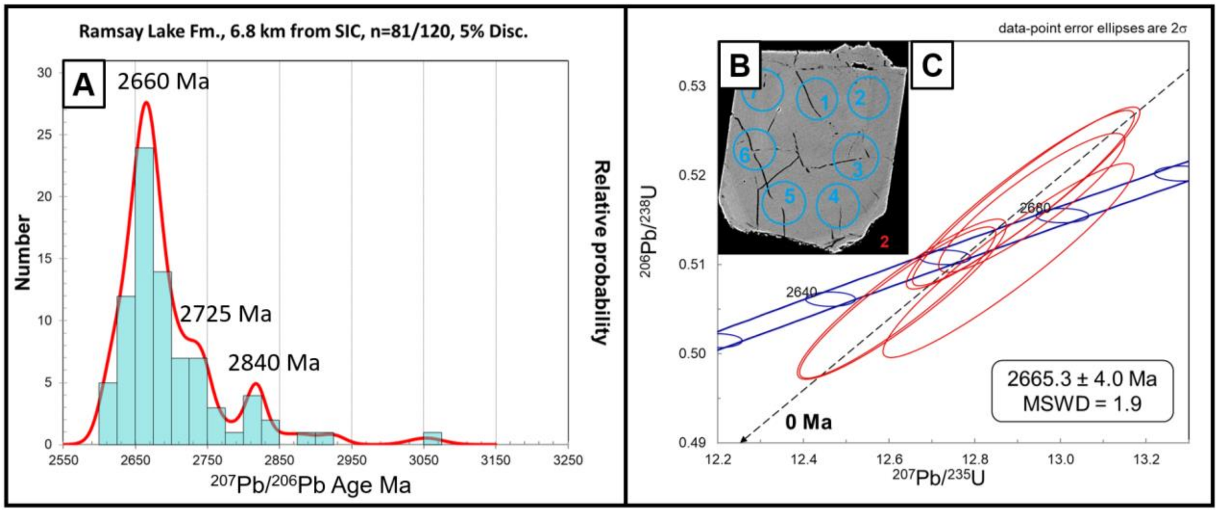


Figure 8: Summary diagram of sample 17JAM001 of the Ramsay Lake Formation in McKim Township, 6.8 km from the Sudbury Igneous Complex. (A) Probability Density Distribution Diagram for the sample. The data plotted is ≤ 5% discordant. (B) Backscatter electron image of zircon #2 along with the locations of the repeat analyses. (C) Wetherill Concordia Diagram of grain #2 from sample 17JAM001. The concordia age of this zircon is 2665.3 ± 4.0 Ma. The PDDD and concordia plot are created using Isoplot (Version 3.75; Ludwig, 2012a).

5.5 Sample 17JAM009

This sample is from the Matinenda Formation and was collected 300m west of Agnew Lake road (Table 1). This sample is approximately 7.5 km from the edge of the Sudbury Igneous Complex in Drury Township, Sudbury, Ontario, Canada (Figure 1 and 2). The zircon range from transparent and clear to cloudy and brown to opaque brown.

For the $^{207}Pb/^{206}Pb$ zircon ages, 104 grains were analyzed for U–Pb geochronology, 43 grains have a discordance value above 5%. The main population of zircon with concordant $^{207}Pb/^{206}Pb$ ages for this sample yields a peak of 2670 Ma with secondary peak at ~2740 Ma; 73% of the grains are within the main peak (Figure 9).

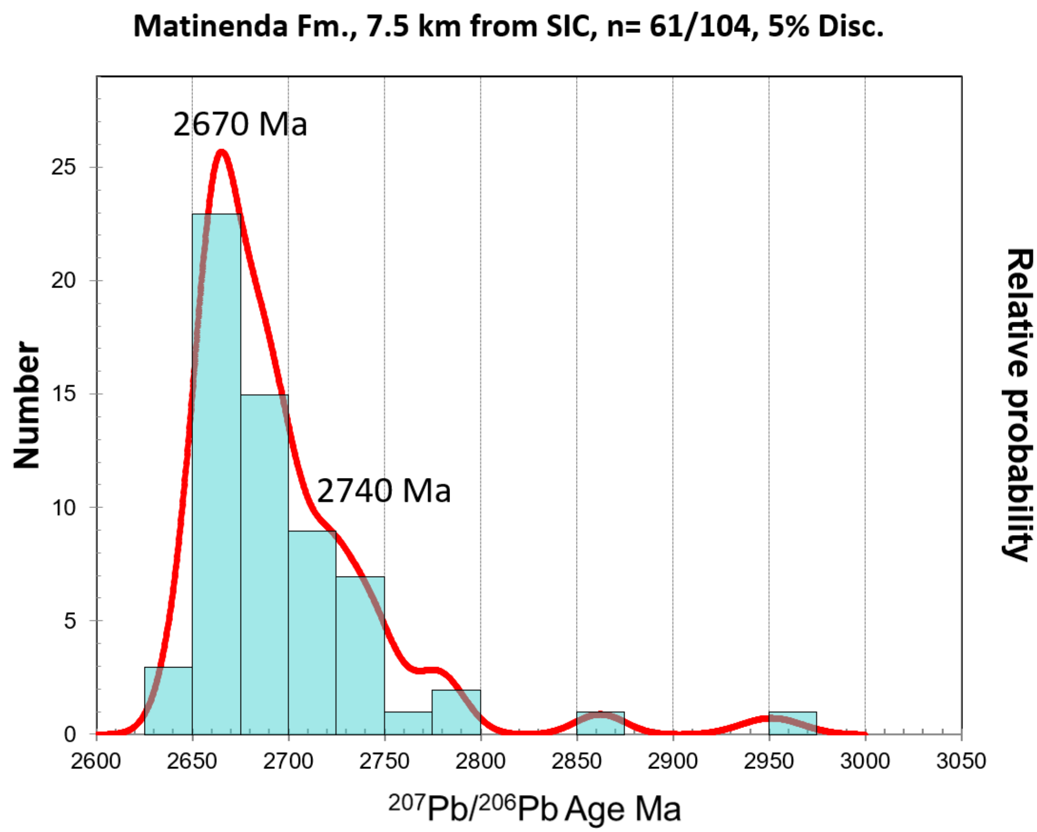


Figure 9: Probability Density Distribution Diagram of Sample 17JAM009 of the Matinenda Formation, 7.5 km from the outer edge of the Sudbury Igneous Complex. The illustrated data is ≤ 5% discordant. The PDDD was created using Isoplot (Version 3.75; Ludwig, 2012a).

5.6 Sample 17JAM011

Sample 17JAM011 is collected off highway 108, approximately 93.3 km from the edge of the Sudbury Igneous Complex in Gunterman Township, Elliot Lake, Ontario, Canada (Table 1) (Figure 2). The sample is a medium to coarse, rounded to subrounded grained sandstone with 1 to 3cm thick cross beds with surface ripples from the Mississagi Formation of the Huronian Supergroup (Figure 1). The zircon is dominantly transparent with light brown staining on the exterior of the grains (Figure 3B).

For the sample, 150 grains were analyzed for U–Pb geochronology, 26 of which have a discordance value above 5%. The main population of zircon with concordant $^{207}Pb/^{206}Pb$ ages for this sample yield a peak of ~2700 Ma with secondary peaks at ~2450 Ma, ~2820 Ma and ~3025 Ma 72% of the grains are within the main peak (Figure 10A).

For the repeat analyses of a single zircon, the $^{207}Pb/^{206}Pb$ ages range from 2685 to 2655 Ma (n=12) and together yield a weighted mean age of 2673.9 ± 3.9 Ma with an MSWD of 1.7 (Figure 10). The repeat analyses of this zircon is consistent with a single crystallization age and is inconsistent with Pb-loss because all the individual analyses are concordant with a low uncertainty and MSWD (Spencer et al. 2017). Error for the repeat analyses of a single grain is below the analytical limit of 1% (Horstwood et al. 2016) and is similar to the baseline established by the secondary standard (Figure 4).

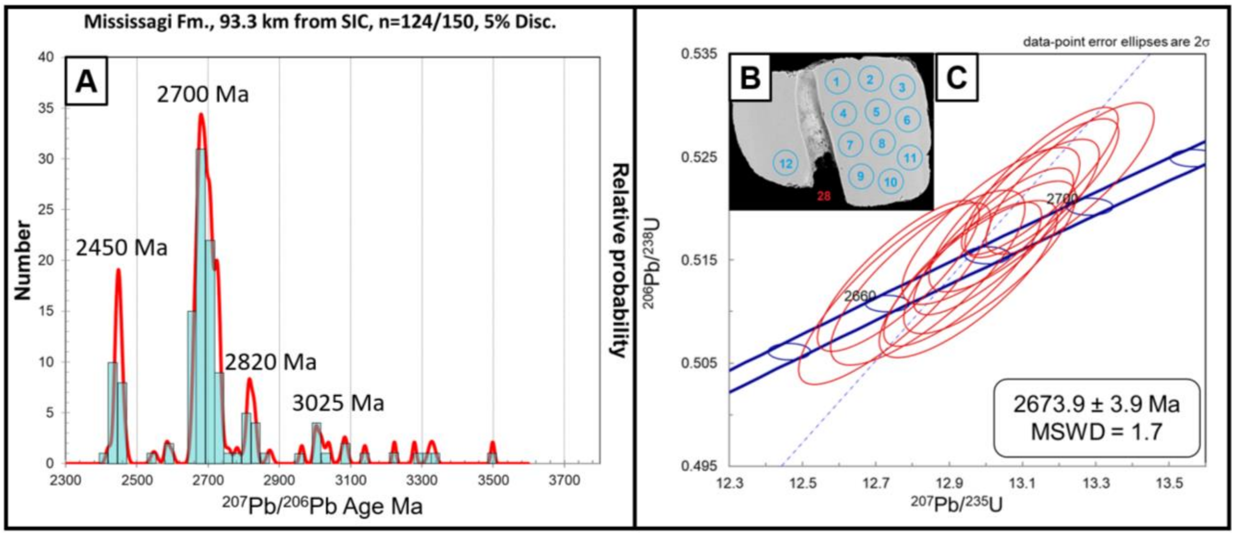


Figure 10: Summary diagram of sample 17JAM011 of the Mississagi Formation in Gunterman Township, 93.3 km from the Sudbury Igneous Complex. (A) Probability Density Distribution Diagram for the sample. The data plotted is ≤ 5% discordance. (B) Backscatter electron image of zircon #28 from sample 17JAM011 whose repeat analyses are labelled in the concordia diagram. (C) Wetherill Concordia Diagram of grain #28 from sample 17JAM011. The concordia age of this zircon is 2673.9 ± 3.9 Ma. The PDDD and concordia plot are created using Isoplot (Version 3.75; Ludwig, 2012a).

6. Discussion

6.1 Discordance

Discordance is the measure of disagreement between the calculated $^{206}Pb/^{238}U$ age and $^{207}Pb/^{206}Pb$ age and is introduced into a zircon by various geologic processes (Wetherill, 1963). If a discordant grain has suffered lead loss or uranium gain it will plot below concordia. If a discordant grain has suffered uranium loss or lead gain it will plot above concordia. Uranium is immobile in zircon at temperatures above the thermally activated blocking temperature for Pb in zircon which is 950°C to 1000°C (Cherniak & Watson, 2000). In a crystalline zircon, uranium has a blocking temperature in excess of 1000 °C and with an effective diffusion diameter of 10 µm, which is a smaller than the zircon analyzed as part of this study, the blocking temperature of uranium is ~1200 °C (Cherniak et al., 1997). The blocking temperature of lead is lower than the blocking temperature of uranium meaning that lead is more vulnerable to high temperature volume diffusion. Therefore, it is uncommon for discordance to be the result of uranium mobility. Discordant U/Pb analyses from this study dominantly plot below concordia, indicating Pb-loss. Repeat analyses of individual zircon demonstrate that Pb-loss does not occur homogeneously throughout a zircon crystal (Figure 6). The percent of discordant zircon within a sample increases as the sample location approaches the SIC (Figure 11). The two closest samples to the SIC have a higher proportion of zircon greater than 5% discordant, with the closest sample having a population that is 69% discordant (Figure 11).

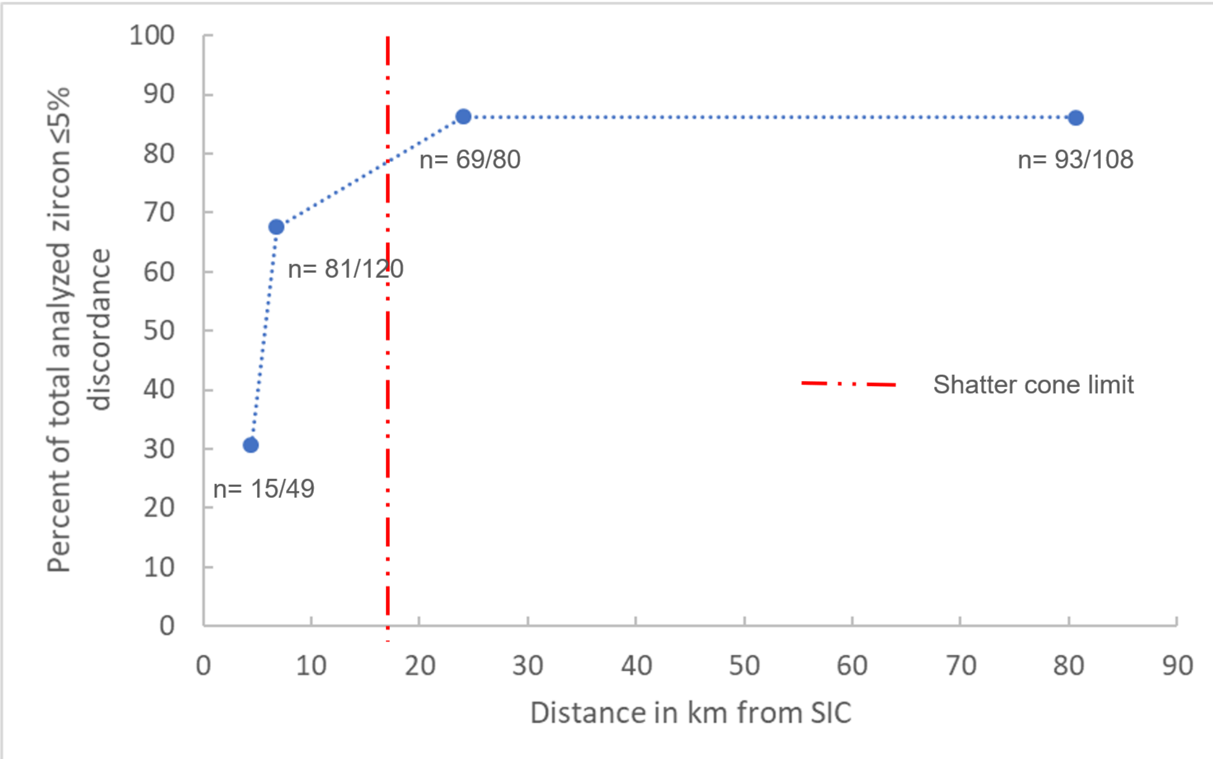


Figure 11: Scatter plot of the percent of the Ramsay Lake Formation sample whose analyzed zircon have a discordance of 5% or smaller (95-105% concordance)* and the apparent present distance from the outer edge of the Sudbury Igneous Complex in kilometers. The shatter cone limit for the Sudbury Impact is approximately 17 km (Dietz, 1964). Data from a single formation is used to prevent differences between formation concordance from affecting the correlation. *Grains more than 5% discordant are considered as discordant zircon.

6.2 Zoning

Zircon textures, such as zoning, can be identified on BSE and CL images on the polished inner surface of a grain. Zircon textures can be associated with distinct geological processes and used to understand the history of the zircon (Corfu et al., 2003; Moser et al., 2008). Igneous zoning is caused by compositional variations in trace elements and is a typical feature of magmatic zircon (Corfu et al., 2003). Igneous zoning appears as concentric regular bands of alternating composition which appear as lighter and darker bands in CL and BSE images. Igneous zoning is a common texture present in a proportion of all the samples. Metamorphic overgrowths are caused by the renewed growth of zircon during metamorphic conditions (Corfu et al., 2003). Metamorphic overgrowths occur as compositionally homogeneous rims over pre-existing zircon. Metamorphic overgrowths could not be confidently identified in any of zircon sampled in this study. Xenocrystic cores are the assimilated often rounded cores of pre-existing zircon into a new magma. When these zircon are assimilated they are often partially resorbed into the magma leaving the core with truncated internal zoning. Xenocrystic cores vary in composition from the rims and can be darker or lighter in BSE and CL images. Textures within the xenocrystic cores are independent of the rest of the zircon and the contrasting orientation of internal textures can identify these cores. Xenocrystic cores are uncommon and were not selected for analysis in this study. The BSE and CL images do not show evidence supporting the presence of multiple age domains such as metamorphic rims or xenocrystic cores (Figure 6B, 6C, 7B and 8B). Chemical alteration affects damaged zircon that have been metamictized and or fractured, providing a plane of entry for fluids. Hydrous fluids are capable of leaching lead from the zircon, leaving the area affected or the zircon ill-suited for U/Pb dating. Alteration is often present along fractures and rims of the zircon and appear as dark (in BSE) envelope around fractures and damaged zones. Alteration is present, to some degree in all of the samples, independent of distance from the SIC. Altered zircon and altered zones were not selected for U/Pb analysis and ^{88}Sr is monitored during U/Pb analysis as a proxy for alteration and inclusions (Davis et al., 2018)

6.3 Metamictization and lead loss

Metamictization is caused by the accumulation of radiation damage in the crystal lattice of zircon and is related to time and to the concentration of uranium (Hay and Dempster, 2009). The higher the concentration of uranium in a zircon the more likely it is to become metamict due to the increased amount of radioactive decay and resulting alpha-recoil damage (Balan et al., 2001). The accumulation of alpha-recoil damage causes the volume of the crystal lattice to expand which creates radial fractures around the metamict zone. These radial fractures leave the zircon vulnerable to chemical alteration. Metamict zones in zircon appear as dark amorphous zones that appear darker in BSE images and have a low CL response (Corfu et al., 2003). The zircon with the highest uranium concentration are the most vulnerable to metamictization. In our dataset however, there is no correlation between the concentration of uranium in zircon and discordance (Figure 12). Most zircon with uranium concentrations > 1000 ppm are also ≤5% discordant (concordant). This indicates that within this dataset, an elevated uranium concentration does not lead to an increase in discordance.

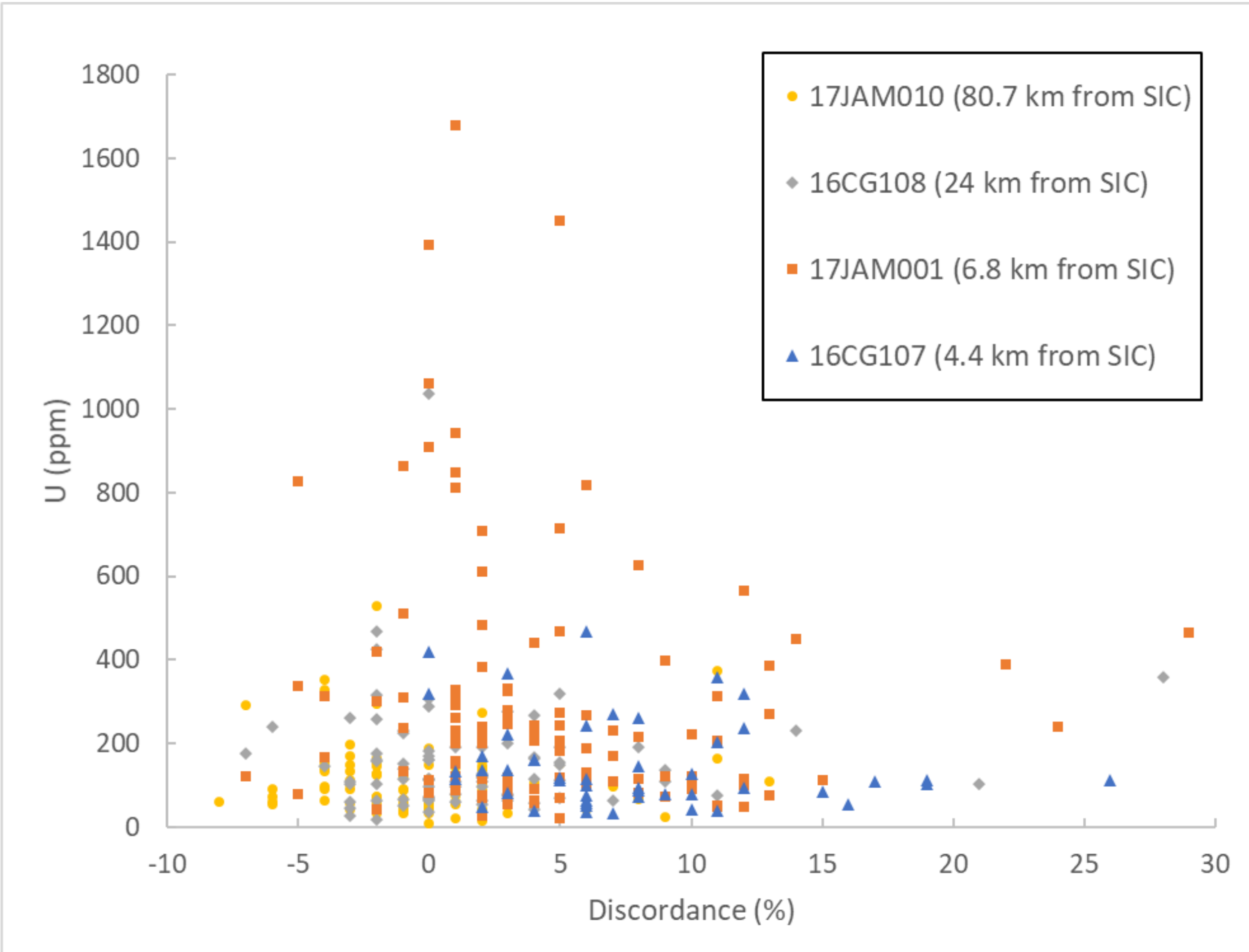


Figure 12: Scatterplot of the percent discordance of individual grains from samples of the Ramsay Lake Formation at varying distances from the Sudbury Igneous Complex against the Uranium concentration.

6.4 Thermally Activated Lead Diffusion

Thermally activated volume diffusion of lead occurs when the blocking temperature for Pb of 950°C to 1000°C for crystalline zircon is exceeded (Cherniak & Watson, 2000). When a zircon exceeds this temperature, Pb diffuses out of the zircon which partially to completely resets the U/Pb age. If lead were diffusing from the zircon, the rims would be predominantly affected, and they would be more likely to have younger partially reset ages. Consider the zircon in Figure 6 from sample 16CG107, this zircon contains zones of different ages but these zones are not distributed in a pattern that would suggest Pb diffusion from the core to the rim. In addition, all the samples are of greenschist metamorphic facies (Figure 3E) and consequently, did not exceed greenschist facies.

6.5 Impact Textures

Impact textures are formed by the high-speed propagation of the shock wave front which is characterised by an interface of extreme pressure and heat, generated during meteorite impacts (Martell, 2016). In the lower pressure regime, impact textures appear as multiple sets of planar deformation features and are a diagnostic texture of impact related zircon (Corfu et al., 2003). At higher pressures, closer to the impact, shocked zircon develop granular textures as they begin to melt and recrystalize (Corfu et al., 2003; Kenny et al., 2019).

The surficial SEM images of zircon from the study in Figure 13 do share textural similarities with other representative shock textured zircon in Figure 13. Multiple sets of planar deformation features (PDF) which are pervasive and repetitive are the most diagnostic texture preserved in shock metamorphosed zircon (Corfu et al., 2003). This texture is only found in shock metamorphosed zircon because the immense energy required to create these textures can only be generated by meteorite impacts. For example, zircon from sample 17JAM009 (Figure 3C and 3D) do not have extensive and pervasive PDF unlike those illustrated in Figure 13 whose fractures are pervasive across the entire grain. However, the conjugate fractures are oriented at a similar angle (Figure 13). Lower pressure regime impact textures are present in a proportion of the samples within 5 km of the SIC in samples 16CG107 and 17JAM002. The presence of diagnostic impact textures support that the increased lead mobility and resulting discordance, within 10 km of the SIC, is related to the Sudbury impact.

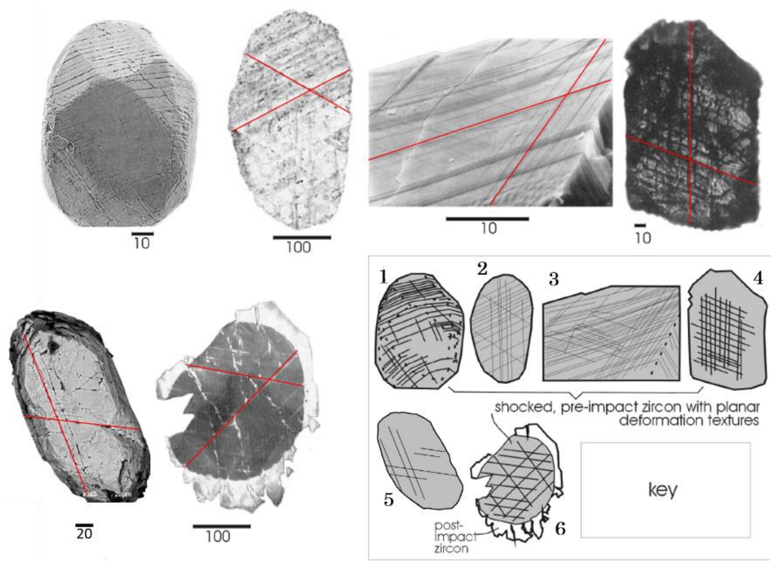


Figure 13: Representative images of the shocked zircon texture from the literature. (1, 2 and 6) from the Vredefort structure. (3) from the Manicouagan impact structure, (4) from the Sudbury structure and (5) surface image of a zircon from sample 17JAM009 of this study from the Sudbury structure. All the illustrated zircon have multiple sets of planar deformation features which is a characteristic texture of impact related zircon. Modified from Corfu et al. (2003).

6.6 Discordance related to the Sudbury Impact

Samples were taken from the Elliot Lake to control and establish a baseline for discordance within samples that are not the result of the Sudbury impact. Elliot Lake is approximately 90 km away from the outer edge of the SIC, whose shatter cone maximum radial distance is ~20km from the SIC (Grieve et al., 1991). Zircon from the samples in the Elliot Lake area are clear with light brown surficial staining under an optical microscope (Figure 3B), and do not have any visible microstructures, or deformation textures visible on the BSE images (Figure 10B). Samples of the Ramsay Lake Formation taken outside the shatter cone limit of the Sudbury Impact have above 80% of the total number of analyzed zircon with ≤5% discordance (Figure 11). Whereas samples of the Ramsay Lake Formation taken within the shatter cone limit of the Sudbury Impact, have a decreasing percent of analyzed zircon with ≤5%, decreasing with increased proximity to the SIC (Figure 11).

The increased discordance in proximity to the SIC can also be seen in the reproducibility of individual zircon ages. For example, grain 28 from sample 17JAM011, 93.3 km from the outer edge of the SIC, is dated using 12 points of analysis and gives a weighted mean age of 2673.9 ±

3.9 Ma with an MSWD of 1.7 (Figure 10) which yields a statistically coherent age that has not been modified by Pb-loss.

6.7 Origin of the 2590 – 2480 Ma detrital zircon population in the Sudbury Area

Samples were taken 4.4 km (16CG107), 5.0 km (17JAM002) and 6.8 km (17JAM001) from the outer edge of the SIC in the Sudbury area. Zircon from these three samples are optically translucent to opaque and visibly brown (Figure 3A) and contain microstructures, deformation textures and alteration textures visible through the BSE and CL images (Figure 6B, 6C, 7B and 8B). Surficial images of representative zircon (Figure 3C and 3D) demonstrate that the fractures seen on the polished inner surface of the zircon are continuous to the surface of the zircon. Fractures, along with cleavage surfaces and dislocations, have the potential to create a pathway for Pb mobilization (Cherniak and Watson, 2000). However, these fractures are not as pervasive as planar deformation features created during high energy meteorite impacts (Krogh et al., 1996).

Sample 16CG107 of the Ramsay Lake Formation sampled 4.4 km away from the SIC contained an anomalously young population of detrital zircon (n=13/49) 2590 – 2480 Ma. Zircon with this range of $^{207}Pb/^{206}Pb$ ages had not been previously found in the Huronian Supergroup and is rare in the source of the Huronian sediments. The source of the Huronian Supergroup is the Superior Province. This is supported by paleocurrent indicators (Long, 1978) and by detrital zircon provenance studies (Craddock et al., 2013; Easton, 2006; Easton and Heaman, 2011; Long et al., 2011; Rainbird and Davis, 2006). Zircon of these ages do not have presently exposed igneous sources on the Superior Province and because they make up ~26% of the analyzed zircon in sample 16CG107, their abundance is difficult to explain. Due to the proximity of these zircon to the Sudbury impact structure, these zircon were reanalyzed to confirm whether these ages are reproducible, which is expect of crystallization ages. Had these ages been true crystallization ages, an igneous source would need to be identified.

Repeat analyses were done on all zircon from this population and $^{207}Pb/^{206}Pb$ ages for these zircon could not be reproduced within uncertainty of the analytical technique. Because these ages could not be reproduced they are interpreted to have suffered Pb-loss. Some zircon also appear to have been partially reset by the Sudbury impact, as discordant analyses trend along a discordia line with the impact event at 1850 Ma (Figure 6A and 7C) (Krogh et al., 1984). In this population, the crystallization age of a zircon and the impact event create a discordia line which lies just below the concordia line making it difficult for concordant and discordant grains to be distinguished with a single spot, especially when considering their analytical uncertainties.

The relative timing of these two events and the relatively large uncertainties of 1.0% associated with LA-ICP-MS analyses (Horstwood et al., 2016) can make it difficult to distinguish between a concordant age and a discordant younger age plotting along a discordia array within uncertainty of the concordia line. Discordant analyses from the 2590-2480 Ma population plot within uncertainty of concordia and a single analysis can appear concordant. But when multiple analyses were conducted on the zircon from this population, the discordant analyses defined a wedge between two discordia lines; their projected crystallization age, the Sudbury impact at 1850 Ma and protracted Pb-loss near 0 Ma. Therefore, the 2590 – 2480 Ma population of zircon is interpreted to be the result of partial Pb-loss of the original crystallization along the 1850 Ma discordia line followed by protracted Pb-loss following a discordia line to 0 Ma. The 2590-2480 Ma ages themselves are the result of partial resetting of the U/Pb age along a shallow discordia array between the crystallization ages and the 1850 Ma Sudbury impact event. A similar population of grains (n=12/102) 2590-2500 Ma is present in sample 17JAM002 of the McKim Fm. 5.0 km from the SIC. This observation demonstrates that the effect of the Sudbury impact is not isolated to a single sample but, is instead widespread in the Sudbury area and affects different lithologies. aThe age of these grains is consistent with mixing ages between their crystallization age and the time of the impact as a result of partial lead-loss. This population is also interpreted to represent partially reset ages as a result of Pb-loss along a discordia line between the crystallization age and the Sudbury impact.

7. Implications

7.1 Implications for the Huronian Supergroup

Based on the variable ages from the same grain and the potential for Pb-loss associated with the Sudbury impact, the previously identified 2590 – 2480 Ma detrital zircon population by Menard, (2017) are not crystallization ages. These ages are consistent with partial resetting of the U/Pb age along a shallow discordia line with the 1850 Ma Sudbury impact event. A similar population of zircon is identified in sample 17JAM002, indicating that partial resetting of a subset of zircon within a sample may occur up to 5 km from the outer edge of the SIC. The impact may have caused a lot of discordance in the samples taken within 7 km from the outer edge of the SIC.

7.2 Implications for all impact structures

Typically, impact related textures and microstructures are used as key indicators when identifying shock metamorphosed zircon. But the absence of these textures and microstructures does not indicate the absence of shock metamorphism. There exists the potential for Pb-loss in zircon sampled in proximity to meteorite impacts even without clear evidence of impact related textures and microstructures. Evidence for Pb-loss and discordance may be preserved in the U/Pb geochronology data. Taking multiple analyses (minimum 3) of single partially reset zircon can indicate whether the U/Pb ratios are statistically univariant, representing a statically coherent age which has not been modified by Pb-loss as a result of an impact. In this study, the samples taken outside the shatter cone limit do not contain impact related textures and over the sample have not suffered a decrease in discordance (Figure 11). To minimize the potential affects of an impact on U/Pb and Pb/Pb isotopes it is recommended to take samples outside the shatter cone limit (Figure 11). It is essential when analyzing samples in proximity to an impact to consider the possibility of partial resetting of the U/Pb and Pb/Pb isotope ratios when choosing a sample location and when interpreting the data.

8. Conclusion

Lead mobility and lead loss is widespread in zircon from sedimentary rocks from the Sudbury area, leading to an increase in discordance in ages in proximity to the SIC (Figure 11). Overall, samples 16CG107, 17JAM002 and 17JAM001 are more densely fractured (Figure 9) and more discordant (Figure 11), which is probably related to the Sudbury meteorite impact, as supported by the zircon texture and U/Pb repeat analyses. The irreproducibility of $^{207}Pb/^{206}Pb$ ages for individual zircon and the increase in overall discordance in samples proximal to the SIC indicate that the 2590-2480 Ma detrital zircon population identified in samples 16CG107 and 17JAM002 (5.0 km from SIC) is the result of partial resetting of the original crystallization age caused by the meteorite impact and subsequent lead loss. This population of zircon is more strongly affected by the meteorite impact and the $^{207}Pb/^{206}Pb$ ages could not be replicated, within uncertainty limits. It is not possible to back calculate the original crystallization age of these zircon since it is not known to what extent the zircon have been partially reset. The $^{207}Pb/^{206}Pb$ ages within 2590- 2480 Ma are mixing ages between the crystallization age of the grain and the Sudbury meteorite impact. This study has indicated that partial resetting of zircon occurs up to at a minimum 5.0 km and an increase in discordance is associated with samples taken within the shatter cone limit of the Sudbury Impact. Samples taken outside the shatter cone limit do not preserve evidence of the impact neither in the zircon texture nor in the U/Pb isotope data. Therefore, samples taken within the shatter cone limit of an impact are more likely to preserve textural evidence of the impact and the U/Pb isotope data is more likely to have been affected by Pb-mobility and partial resetting.

9. References

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10. Appendix A

Results of U-Pb Zircon LA-ICP-MS Geochronology

17JAM001 - Ramsay Lake Formation - McKim Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M23-1	0.297695	182	0.77	0.18515	0.00097682	12.8695	0.19743	0.49866	0.0064404	0.84192	2718	14	2670	14	2608	28	5
M23-2	0.20929	48	0.36	0.18424	0.0016542	11.8251	0.18635	0.46262	0.0053549	0.73451	2702	18	2591	15	2451	24	11
M23-3	0.41185	212	0.53	0.17816	0.00087961	11.9416	0.15114	0.48537	0.0049439	0.80477	2638	12	2600	12	2551	21	4
M23-4	0.7963	200	1.66	0.17966	0.00092122	12.2444	0.1684	0.49579	0.0055945	0.82046	2645	13	2623	13	2596	24	2
M23-5	0.66374	80	0.38	0.21406	0.0018022	17.645	0.2999	0.60241	0.0079458	0.77605	2924	17	2971	16	3040	32	-5
M23-6	0.35795	105	0.85	0.16381	0.001031	9.1725	0.13245	0.41086	0.0045915	0.7739	2476	15	2355	13	2219	21	12
M23-7	0.26332	76	0.45	0.17868	0.0012952	10.6032	0.15653	0.43516	0.0049426	0.7694	2622	16	2489	14	2329	22	13
M23-8	32.0087	81	0.69	0.1826	0.0016105	11.6853	0.18635	0.46901	0.0055901	0.7474	2659	18	2580	15	2479	25	8
M23-9	0.15698	239	0.14	0.18263	0.0010456	12.4845	0.18217	0.50071	0.0059642	0.81631	2661	14	2642	14	2617	26	2
M23-10	0.21295	126	0.42	0.18498	0.0011781	12.2045	0.18329	0.48296	0.0056567	0.7799	2683	16	2620	14	2540	25	6
M23-11	0.25682	122	0.7	0.17648	0.0012317	10.8827	0.19139	0.44946	0.0063345	0.80138	2612	18	2513	16	2393	28	10
M23-12	0.23718	100	0.85	0.23632	0.0030817	17.6889	0.37651	0.54385	0.0082996	0.71696	3092	24	2973	20	2800	35	12
M23-13	0.13614	244	1.03	0.18013	0.0012118	12.0616	0.19842	0.48499	0.0064445	0.80776	2656	16	2609	15	2549	28	5
M23-15	0.25443	114	0.49	0.19185	0.0017756	13.056	0.24948	0.49135	0.0073104	0.7786	2765	20	2684	18	2577	32	8
M23-16	0.2981	121	0.41	0.18856	0.0014651	12.686	0.24685	0.48421	0.0075002	0.79605	2742	19	2657	18	2546	33	9
M23-17	0.288	219	0.56	0.19143	0.0015324	13.7199	0.33539	0.51573	0.010945	0.86819	2767	20	2731	23	2681	46	4
M23-18	0.83707	240	0.83	0.17733	0.002384	9.381	0.27445	0.38178	0.0094173	0.84315	2636	26	2376	27	2085	44	24
M23-21	0.14985	88	0.66	0.18787	0.0018328	13.3183	0.26341	0.5131	0.0078779	0.7763	2727	20	2702	19	2670	34	3
M23-22	0.41	314	0.59	0.19007	0.0017056	12.3845	0.24562	0.47299	0.0074675	0.79604	2741	20	2634	19	2497	33	11
M23-24	0.36281	467	0.56	0.17786	0.0010365	11.6147	0.18718	0.47541	0.0058092	0.75823	2627	18	2574	15	2507	25	5
M23-27	0.236	187	0.31	0.19153	0.0018239	12.9894	0.2711	0.49663	0.0078769	0.75995	2740	22	2679	20	2599	34	6
M23-28	0.20729	202	0.67	0.17896	0.0014671	11.6446	0.19818	0.47651	0.0059084	0.72856	2627	19	2576	16	2512	26	5
M23-30	0.23481	65	0.22	0.20475	0.0020364	14.9901	0.29155	0.53617	0.0080084	0.76797	2849	20	2815	18	2767	34	4
M23-31	0.42341	166	0.66	0.19311	0.0015339	14.6037	0.26597	0.55386	0.0080746	0.80049	2753	18	2790	17	2841	33	-4
M23-33	0.16765	76	0.41	0.19034	0.002048	13.4018	0.26367	0.5157	0.0073512	0.72454	2729	22	2708	19	2681	31	2
M23-34	0.16054	217	0.5	0.18492	0.0015566	12.9486	0.23016	0.5118	0.0067563	0.74269	2685	20	2676	17	2664	29	1
M23-35	0.27631	52	0.54	0.17405	0.002205	10.4405	0.21863	0.43751	0.006497	0.70916	2588	25	2475	19	2339	29	11
M23-36	0.16443	317	0.67	0.18176	0.001347	12.6464	0.19985	0.50637	0.0060402	0.75481	2663	17	2654	15	2641	26	1
M23-38	0.23165	420	0.21	0.18275	0.0014962	13.1499	0.2334	0.52258	0.0072395	0.78049	2676	18	2690	17	2710	31	-2
M23-40	0.30661	111	0.33	0.18912	0.0022381	11.6622	0.24188	0.44688	0.0066563	0.71817	2736	24	2578	19	2381	30	15
M23-41	0.18541	98	0.54	0.19572	0.0020407	14.1714	0.28053	0.5238	0.0073805	0.7118	2795	23	2761	19	2715	31	3
M23-42	0.22712	102	0.41	0.22664	0.0028684	16.8	0.35243	0.53759	0.0079424	0.70426	3029	24	2923	20	2773	33	10
M23-43	0.55956	217	0.21	0.19246	0.0016937	12.9488	0.22398	0.48916	0.0064164	0.75835	2759	18	2676	16	2567	28	8
M23-44	0.148	314	0.64	0.1815	0.0013974	13.2595	0.22884	0.53246	0.0073389	0.79863	2658	17	2698	16	2752	31	-4
M23-46	0.17472	59	0.3	0.19266	0.002	13.5525	0.25141	0.51399	0.0068592	0.71937	2753	21	2719	18	2674	29	4
M23-47	0.14444	121	0.71	0.18184	0.0017179	12.525	0.23019	0.5049	0.0069303	0.74686	2652	20	2645	17	2635	30	1
M23-48	0.17161	48	0.31	0.17294	0.0020859	10.0929	0.20151	0.4281	0.006111	0.71495	2567	23	2443	18	2297	28	12
M23-49	0.18891	151	0.68	0.19103	0.0019764	13.5586	0.253	0.52102	0.0072714	0.74792	2731	20	2719	18	2704	31	1
M23-50	0.319	131	0.45	0.19757	0.0020633	13.639	0.24503	0.50715	0.006468	0.70991	2785	21	2725	17	2644	28	6
M23-51	0.16519	90	0.41	0.17723	0.001622	10.8584	0.20148	0.45041	0.0063262	0.75694	2605	20	2511	17	2397	28	10

17JAM001 - Ramsay Lake Formation - McKim Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M23-52	0.14666	120	0.43	0.185	0.0016397	15.1637	0.3218	0.57302	0.0097407	0.80103	2759	21	2826	20	2920	40	-7
M23-54	0.15111	236	0.45	0.18919	0.0014878	16.2917	0.29871	0.57004	0.0081839	0.78301	2884	19	2894	18	2908	34	-1
M23-56	0.21411	21	0.36	0.19829	0.0024849	18.2617	0.40714	0.57547	0.009424	0.73453	3053	24	3004	21	2930	39	5
M23-58	0.25946	102	0.53	0.18449	0.0014867	17.6858	0.32076	0.56344	0.0071929	0.70389	3036	21	2973	17	2881	30	6
M29A-1	0.68465	115	0.85	0.17963	0.0011619	11.3325	0.13449	0.45314	0.0040504	0.75319	2666	13	2551	11	2409	18	12
M29A-2	0.31489	865	0.05	0.17968	0.00075195	12.8788	0.13411	0.51496	0.0044636	0.83238	2666	10	2671	10	2678	19	-1
M29A-3	0.183	92	0.79	0.18076	0.001002	12.4963	0.14503	0.4968	0.004688	0.8131	2675	11	2642	11	2600	20	3
M29A-4	0.27072	226	1.59	0.18188	0.00084146	12.7774	0.14302	0.50497	0.0047214	0.83532	2685	10	2663	11	2635	20	2
M29A-5	0.16304	54	0.85	0.1786	0.0012049	12.2671	0.16596	0.49381	0.0053432	0.79979	2654	13	2625	13	2587	23	3
M29A-6	2.3975	847	0.4	0.17909	0.00092934	12.6543	0.15014	0.50775	0.0049206	0.81679	2660	11	2654	11	2647	21	1
M29A-7	0.50861	109	0.6	0.18053	0.0013762	11.9845	0.16953	0.47667	0.0053312	0.79065	2674	14	2603	13	2513	23	7
M29A-8	0.15363	71	1.07	0.18036	0.0015238	12.5516	0.18269	0.49932	0.0055307	0.761	2674	16	2647	14	2611	24	3
M29A-9	0.35676	159	1	0.18063	0.0010997	12.8127	0.16257	0.50857	0.0051197	0.79341	2678	13	2666	12	2651	22	1
M29A-10	1.761	332	0.34	0.18301	0.0010005	12.9384	0.1665	0.50652	0.0051759	0.79404	2701	13	2675	12	2642	22	3
M29A-11	0.3805	206	0.77	0.17821	0.0010037	12.1337	0.1412	0.48858	0.0043617	0.76715	2654	12	2615	11	2565	19	4
M29A-12	0.54521	199	1.06	0.17928	0.0010919	12.0981	0.14569	0.48485	0.0045337	0.77649	2662	13	2612	11	2548	20	5
M29A-13	0.16397	92	0.53	0.18772	0.0011399	13.2193	0.16823	0.50658	0.0051879	0.80475	2736	12	2695	12	2642	22	4
M29A-14	0.43886	246	0.71	0.17391	0.00093922	11.6818	0.13517	0.48382	0.0043706	0.78072	2607	12	2579	11	2544	19	3
M29A-15	0.22524	119	1.07	0.18266	0.000948	12.3982	0.15487	0.48949	0.0048923	0.80012	2687	12	2635	12	2568	21	5
M29A-16	0.2899	257	0.61	0.18397	0.00090397	12.8051	0.15404	0.50311	0.004835	0.79889	2695	12	2665	11	2627	21	3
M29A-17	0.59158	943	0.55	0.19882	0.00079316	14.9557	0.15485	0.54431	0.0044959	0.79777	2820	10	2812	10	2801	19	1
M29A-19	0.23912	482	0.8	0.18152	0.00074689	12.5984	0.13754	0.50275	0.0044762	0.81556	2669	10	2650	10	2626	19	2
M29A-20	0.5447	329	0.41	0.18899	0.00077339	13.6381	0.15573	0.5233	0.0048451	0.81081	2734	11	2725	11	2713	20	1
M29A-22	0.21567	293	0.68	0.1816	0.00075716	12.6887	0.14952	0.50723	0.004638	0.77599	2666	12	2657	11	2645	20	1
M29A-23	0.15514	118	0.98	0.18212	0.00097006	12.5526	0.15408	0.49991	0.0048031	0.78272	2672	13	2647	12	2613	21	3
M29A-24	0.18286	202	0.83	0.18244	0.00080459	12.8416	0.14633	0.51001	0.0047437	0.81623	2677	11	2668	11	2657	20	1
M29A-25	0.15554	116	0.8	0.18024	0.00092268	12.4561	0.13992	0.50022	0.0044359	0.78946	2658	11	2639	11	2615	19	2
M29A-26	0.20964	70	0.59	0.18701	0.0010928	12.8379	0.1523	0.49639	0.0045561	0.7737	2721	12	2668	11	2598	20	5
M29A-27	0.24754	112	0.43	0.18495	0.00090377	13.3995	0.17027	0.52336	0.005505	0.82775	2704	12	2708	12	2713	23	0
M29A-28	0.28267	261	0.57	0.18073	0.00071306	12.7167	0.14099	0.50784	0.0045795	0.81333	2668	11	2659	10	2647	20	1
M29A-31	0.27564	69	0.47	0.18106	0.00099204	12.6604	0.15734	0.50474	0.005111	0.81479	2670	12	2655	12	2634	22	2
M29A-32	0.64942	301	0.59	0.18997	0.00092821	14.2305	0.16711	0.54079	0.0051672	0.81364	2749	11	2765	11	2787	22	-2
M29A-33	0.20114	610	1.09	0.17871	0.00076003	12.3083	0.14602	0.49728	0.0048234	0.81762	2648	11	2628	11	2602	21	2
M29A-34	0.97683	817	0.36	0.18104	0.00075475	12.0593	0.15392	0.48101	0.0049562	0.80728	2670	12	2609	12	2532	22	6
M29A-35	0.51367	2122	0.24	0.1984	0.00096735	14.9233	0.19118	0.54281	0.0055633	0.80002	2821	13	2810	12	2795	23	1
M29A-36	0.62541	716	0.41	0.18589	0.0010557	12.8307	0.16179	0.49794	0.0047972	0.76404	2715	13	2667	12	2605	21	5
M29A-37	0.38047	204	1.12	0.17702	0.0014347	11.7657	0.17422	0.47929	0.0051474	0.72527	2635	17	2586	14	2524	22	5
M29A-38	0.34009	625	1.13	0.18439	0.0010316	12.228	0.17216	0.47803	0.005208	0.77381	2703	15	2622	13	2519	23	8
M29A-39	0.23554	207	0.95	0.18404	0.0012515	11.8163	0.18737	0.46266	0.0054991	0.74958	2700	17	2590	15	2451	24	11
M29A-40	0.45139	397	1.53	0.17867	0.001051	11.3937	0.16316	0.46075	0.004809	0.72886	2647	16	2556	13	2443	21	9
M29A-41	0.18094	268	1.01	0.18342	0.0011824	12.2843	0.17709	0.48537	0.0052889	0.75587	2685	16	2626	14	2551	23	6
M29A-42	0.19888	230	0.99	0.1836	0.0011509	12.1669	0.17594	0.48173	0.005423	0.77847	2682	15	2617	14	2535	24	7
M29A-43	1.176	566	0.46	0.17478	0.0010136	10.4317	0.14007	0.43518	0.0043215	0.73957	2595	15	2474	12	2329	19	12

17JAM001 - Ramsay Lake Formation - McKim Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig 1	206Pb/ 238U	Sig1	%Disc
M29A-44	0.16643	440	0.02	0.18191	0.0010652	12.1355	0.18614	0.48789	0.005747	0.76795	2657	16	2615	14	2562	25	4
M29A-45	0.88701	115	0.83	0.18731	0.0014718	12.768	0.19659	0.49813	0.0056006	0.73024	2706	17	2663	14	2606	24	5
M29A-46	1.7445	272	0.61	0.18555	0.0013055	12.4933	0.18797	0.49109	0.0057633	0.78003	2694	16	2642	14	2575	25	5
M29A-47	0.17771	87	0.4	0.1833	0.0012534	12.7753	0.18259	0.50739	0.0056134	0.77405	2677	15	2663	13	2645	24	1
M29A-48	0.80829	710	0.45	0.17682	0.00093851	11.9978	0.1626	0.49301	0.0053671	0.8033	2620	13	2604	13	2584	23	2
M29A-50	0.64646	169	0.91	0.18632	0.0013386	12.5246	0.186	0.4875	0.0054323	0.75036	2710	16	2645	14	2560	24	7
M29A-51	0.55648	309	0.81	0.17979	0.0010341	12.7555	0.18125	0.51523	0.0060199	0.82226	2649	13	2662	13	2679	26	-1
M29A-52	0.148	83	0.79	0.18182	0.0013551	12.7463	0.18719	0.51079	0.0057925	0.77219	2662	15	2661	14	2660	25	0
M29B-1	0.46113	512	0.51	0.18158	0.00076466	13.0117	0.16521	0.51982	0.0055038	0.8339	2667	12	2681	12	2698	23	-1
M29B-3	6.2426	466	0.23	0.17836	0.00083961	8.7914	0.22789	0.35857	0.0088396	0.95101	2633	13	2317	23	1975	42	29
M29B-4	2.4845	449	0.44	0.17681	0.00083839	10.36	0.17751	0.42747	0.0062005	0.84657	2613	15	2467	16	2294	28	14
M29B-5	0.23645	232	0.72	0.17878	0.00096807	12.1403	0.20369	0.49681	0.0063844	0.76593	2627	18	2615	16	2600	27	1
M29B-6	0.60697	908	1.18	0.17799	0.00072565	12.0902	0.21013	0.49835	0.0063924	0.73802	2615	20	2611	16	2607	28	0
M29B-7	1.065	812	0.93	0.18099	0.0011222	12.5194	0.259	0.50545	0.0083197	0.79563	2650	21	2644	19	2637	36	1
M29B-9	0.14	206	0.07	0.17638	0.001225	11.617	0.19271	0.47798	0.0055772	0.70339	2618	20	2574	16	2518	24	5
M29B-10	0.15664	1678	0.07	0.17893	0.0006527	12.5154	0.18284	0.5041	0.005539	0.75211	2653	16	2644	14	2631	24	1
M29B-11	0.62709	1452	0.64	0.18144	0.00075564	12.4861	0.19371	0.49254	0.005791	0.75787	2688	17	2642	15	2582	25	5
M29B-12	0.24514	1393	0.94	0.17719	0.00067823	12.7012	0.21975	0.50944	0.006759	0.76686	2660	18	2658	16	2654	29	0
M29B-14	0.27867	222	0.79	0.18247	0.0011097	12.1372	0.19383	0.47094	0.0055292	0.73518	2715	18	2615	15	2488	24	10
M29B-15	0.205	244	0.78	0.17449	0.0009018	11.9225	0.1906	0.48455	0.0063623	0.82131	2639	15	2598	15	2547	28	4
M29B-16	2.1808	389	0.37	0.17752	0.00087177	9.9884	0.14053	0.39966	0.0046162	0.82094	2664	13	2434	13	2167	21	22
M29B-17	0.159	110	0.65	0.18006	0.00098381	12.7174	0.18911	0.50251	0.0063404	0.84852	2685	13	2659	14	2625	27	3
M29B-18	0.35721	206	0.48	0.18694	0.00089723	13.246	0.17997	0.50494	0.0057618	0.83985	2744	12	2697	13	2635	25	5
M29B-19	0.23487	222	0.37	0.17716	0.00075289	12.0444	0.16789	0.4865	0.0058801	0.8671	2649	12	2608	13	2556	26	4
M29B-21	0.19419	72	0.15	0.18305	0.0012895	12.0938	0.20896	0.47398	0.0069913	0.85368	2699	15	2612	16	2501	31	9
M29B-22	0.14798	26	0.21	0.18554	0.0021421	13.2603	0.30332	0.51402	0.0095926	0.81583	2717	22	2698	22	2674	41	2
M29B-23	0.14714	271	0.54	0.17879	0.0012844	11.0373	0.27919	0.44514	0.010222	0.9078	2651	18	2526	24	2374	46	13
M29B-26	1.8777	386	0.15	0.18235	0.00096474	11.3321	0.33435	0.44924	0.012333	0.93042	2680	18	2551	28	2392	55	13
M29B-27	0.2391	325	1.38	0.17875	0.0011514	12.0604	0.32243	0.49022	0.012012	0.91655	2638	18	2609	25	2572	52	3
M29B-28	0.146	382	1.04	0.17725	0.0010441	12.0392	0.26294	0.49415	0.0096541	0.89455	2622	16	2607	21	2589	42	2
M29B-30	0.18339	2830	0.25	0.2008	0.00061283	15.0222	0.27215	0.54499	0.0088083	0.89214	2825	13	2817	17	2804	37	1
M29B-31	0.22534	1062	0.68	0.19823	0.00079551	14.8137	0.24915	0.5451	0.0077625	0.84669	2802	15	2803	16	2805	32	0
M29B-33	0.15878	281	1.23	0.18329	0.0011167	12.5566	0.21721	0.50035	0.0067616	0.78122	2671	18	2647	16	2615	29	3
M29B-35	0.16572	74	0.64	0.17905	0.0014252	11.33	0.18304	0.46103	0.0054679	0.73415	2637	18	2551	15	2444	24	9
M29B-36	0.14756	828	0.52	0.17771	0.0007138	12.8605	0.16675	0.52627	0.0055251	0.80973	2627	13	2669	12	2726	23	-5
M29B-37	0.15979	135	0.03	0.18398	0.0010868	13.2538	0.17348	0.5229	0.0053378	0.77989	2688	14	2698	12	2711	23	-1
M29B-38	0.15076	43	0.47	0.18322	0.0013509	13.2887	0.20164	0.52545	0.0063793	0.80009	2684	15	2700	14	2722	27	-2
M29B-40	0.24749	336	0.23	0.1975	0.00075359	15.6611	0.19474	0.57342	0.0059979	0.84119	2810	11	2856	12	2922	25	-5

17JAM002 - McKim Formation - McKim Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	RhoXY	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	%Disc
M23-1	0.14227	141	0.4	0.18009	0.001385	11.9302	0.19285	0.47914	0.0056442	0.72873	2658	18	2599	15	2524	25	6
M23-3	0.15719	364	0.58	0.17544	0.00098815	11.6114	0.16233	0.47956	0.0049961	0.74519	2612	16	2574	13	2525	22	4
M23-4	0.14443	104	0.22	0.1824	0.0017193	12.2441	0.2033	0.48726	0.0055795	0.68964	2673	20	2623	16	2559	24	5
M23-5	0.36097	313	0.54	0.17168	0.0010571	10.5756	0.16408	0.44793	0.0052604	0.75694	2570	17	2487	14	2386	23	9
M23-6	0.22059	201	0.63	0.18097	0.0013386	11.7762	0.20906	0.47403	0.0063216	0.75121	2655	19	2587	17	2501	28	7
M23-7	0.14594	200	0.45	0.17689	0.0012903	10.9542	0.18235	0.45151	0.0054737	0.72825	2615	19	2519	16	2402	24	10
M23-8	0.17147	87	0.27	0.18417	0.0015991	12.1304	0.20526	0.47982	0.0060315	0.7429	2683	19	2615	16	2526	26	7
M23-9	0.47767	137	0.3	0.1833	0.0011026	12.1543	0.1561	0.48262	0.0046294	0.74686	2677	14	2616	12	2539	20	6
M23-10	0.16216	93	0.24	0.18167	0.0013385	12.4898	0.1658	0.49996	0.0048308	0.72786	2664	15	2642	12	2614	21	2
M23-11	0.15056	42	0.16	0.18427	0.0016045	12.6497	0.18472	0.49879	0.0052063	0.7148	2689	17	2654	14	2609	22	4
M23-12	0.20704	79	0.28	0.18252	0.0013042	12.4269	0.16252	0.49272	0.0048806	0.75741	2680	14	2637	12	2582	21	4
M23-13	0.20778	109	0.12	0.17713	0.0010869	12.5094	0.14778	0.51025	0.0046477	0.77103	2633	12	2643	11	2658	20	-1
M23-15	0.14202	52	0.28	0.18347	0.0013924	12.7453	0.16736	0.50113	0.0049048	0.74539	2693	14	2661	12	2619	21	3
M23-16	0.37077	118	0.21	0.18239	0.001085	12.0221	0.1601	0.47472	0.0051969	0.82205	2686	13	2606	12	2504	23	8
M23-17	0.53809	269	0.3	0.17601	0.0010707	11.832	0.15737	0.48338	0.0051074	0.79443	2630	13	2591	12	2542	22	4
M23-18	0.40624	107	0.36	0.18136	0.001059	12.2241	0.16267	0.48439	0.0052054	0.80753	2681	13	2622	12	2546	23	6
M23-19	0.18854	26	0.16	0.17174	0.0020443	10.6663	0.18046	0.44681	0.0049337	0.65266	2588	21	2494	16	2381	22	10
M23-20	0.14535	61	0.12	0.18035	0.0014205	12.2148	0.18086	0.48777	0.0056559	0.78313	2668	15	2621	14	2561	24	5
M23-21	0.38391	53	0.16	0.16854	0.0015858	10.5347	0.1764	0.45064	0.0057711	0.76482	2553	18	2483	15	2398	26	7
M23-22	0.17785	47	0.17	0.1667	0.0015145	10.6881	0.1662	0.46273	0.0050984	0.70857	2533	18	2496	14	2452	22	4
M23-23	0.17861	167	0.34	0.1811	0.0011474	12.5858	0.17623	0.50557	0.0055468	0.78353	2658	14	2649	13	2638	24	1
M23-24	0.41645	147	0.19	0.18771	0.0013132	12.7106	0.19477	0.49431	0.0059613	0.78702	2712	16	2658	14	2589	26	5
M23-25	0.28526	118	0.48	0.1777	0.0011592	11.5027	0.17291	0.47413	0.0053944	0.75685	2615	16	2565	14	2502	24	5
M23-28	0.31742	120	0.44	0.17101	0.0012114	10.5501	0.20115	0.45342	0.0069851	0.80799	2545	19	2484	18	2410	31	6
M23-30	0.12346	28	0.41	0.17194	0.0024622	10.5826	0.23303	0.45343	0.0064918	0.6502	2550	28	2487	20	2410	29	7
M23-31	0.35078	103	0.99	0.16667	0.0013618	9.1375	0.15185	0.40347	0.0048625	0.72521	2500	19	2352	15	2185	22	15
M23-33	0.36015	72	0.19	0.18259	0.001787	11.0514	0.20081	0.44498	0.005629	0.69621	2654	22	2527	17	2373	25	13
M23-34	0.19459	489	0.56	0.18122	0.00088283	12.2581	0.2123	0.49678	0.0064923	0.7546	2643	19	2624	16	2600	28	2
M23-35	0.5898	355	0.65	0.19098	0.0011862	14.2325	0.26142	0.54696	0.0079343	0.78977	2731	19	2765	17	2813	33	-4
M23-36	1.4768	184	0.39	0.1835	0.0013353	12.0168	0.20931	0.48072	0.0064798	0.77386	2665	18	2606	16	2530	28	6
M23-37	0.18786	320	0.25	0.18066	0.0011332	13.2802	0.24778	0.53971	0.008527	0.84679	2639	16	2700	18	2782	36	-7
M23-38	0.51324	82	0.19	0.1606	0.0017342	7.5886	0.13941	0.34701	0.0044071	0.69133	2441	22	2184	16	1920	21	25
M23-39	0.33	184	0.72	0.18472	0.001393	13.054	0.23785	0.51905	0.0074331	0.78595	2675	19	2684	17	2695	32	-1
M23-40	0.16065	99	0.47	0.18596	0.0017032	13.0613	0.24519	0.5149	0.0073158	0.75686	2689	20	2684	18	2678	31	1
M23-41	0.29667	199	0.35	0.18274	0.0013173	11.5071	0.19807	0.46066	0.0063561	0.80161	2664	17	2565	16	2442	28	10
M23-43	0.99502	247	0.7	0.19236	0.0013123	13.6642	0.22597	0.51855	0.0068477	0.79852	2752	16	2727	16	2693	29	3
M23-44	0.12914	33	0.6	0.18624	0.0023352	13.1557	0.27635	0.51458	0.007656	0.70827	2702	24	2691	20	2676	33	1
M23-45	0.36693	298	0.12	0.18193	0.0013101	11.6929	0.21496	0.4672	0.0066355	0.77256	2667	19	2580	17	2471	29	9
M23-46	0.16458	227	1	0.18418	0.0013391	13.1936	0.20752	0.51453	0.0063165	0.78051	2707	16	2694	15	2676	27	1
M23-47	0.16281	83	0.95	0.18322	0.0014723	12.9451	0.2197	0.5056	0.0068482	0.79807	2704	17	2676	16	2638	29	3
M23-53	0.46288	323	0.58	0.1817	0.0015284	13.0329	0.24254	0.51341	0.0078755	0.82426	2690	17	2682	18	2671	34	1

17JAM002 - McKim Formation - McKim Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb / 238U	Sig1	%Disc
M23-55	0.19119	43	0.83	0.17632	0.0019769	12.0624	0.22791	0.49164	0.0069115	0.74403	2634	21	2609	18	2578	30	3
M23-57	0.43366	322	0.95	0.17766	0.0013817	12.1809	0.20448	0.49468	0.0066984	0.80663	2640	16	2618	16	2591	29	2
M23-58	0.43928	126	1.05	0.18582	0.001447	12.8613	0.22853	0.50136	0.0071291	0.80026	2708	18	2670	17	2620	31	4
M23-60	0.2527	216	0.63	0.1818	0.0018552	12.0493	0.2349	0.48148	0.0072389	0.77122	2667	20	2608	18	2534	31	6
M23-62	0.33752	161	0.42	0.19753	0.0017046	13.723	0.23763	0.50444	0.0067265	0.77006	2804	18	2731	16	2633	29	7
M23-63	0.35786	73	0.14	0.15875	0.0018434	7.9611	0.1784	0.36394	0.0064507	0.79094	2441	23	2227	20	2001	30	21
M23-65	0.48033	317	0.29	0.17654	0.0014147	11.7137	0.22781	0.48127	0.0075683	0.80859	2620	19	2582	18	2533	33	4
M23-66	0.26831	270	0.37	0.18714	0.0015336	12.396	0.23963	0.48022	0.0070964	0.76443	2718	21	2635	18	2528	31	8
M23-68	0.16011	119	0.29	0.17714	0.0015977	11.5307	0.22266	0.47199	0.0068908	0.75606	2627	21	2567	18	2492	30	6
M23-69	0.59299	94	0.16	0.16797	0.0017437	8.8035	0.19022	0.38027	0.0066404	0.80815	2537	21	2318	20	2078	31	21
M23-71	0.2393	189	1.16	0.17248	0.0012101	11.0988	0.18169	0.46719	0.0061588	0.80526	2580	16	2531	15	2471	27	5
M23-73	0.3101	92	0.32	0.18598	0.0017556	12.8397	0.2476	0.50159	0.0076395	0.7898	2704	19	2668	18	2621	33	4
M23-75	0.23841	56	0.27	0.17391	0.0015452	10.6217	0.19072	0.4447	0.0063126	0.79059	2589	18	2491	17	2372	28	10
M23-76	0.18033	79	1.02	0.17699	0.0014264	11.6502	0.19078	0.47962	0.0062126	0.79098	2617	17	2577	15	2526	27	4
M23-77	0.53445	109	0.19	0.17567	0.0015655	10.4765	0.18898	0.43488	0.0063248	0.80625	2603	18	2478	17	2328	28	13
M23-79	0.21533	62	0.31	0.16711	0.0015361	9.948	0.17493	0.43443	0.0059208	0.77504	2518	19	2430	16	2326	27	9
M23-80	0.20223	92	0.43	0.17997	0.0015003	11.8938	0.22305	0.48265	0.0073711	0.81436	2641	18	2596	18	2539	32	5
M23-81	0.16743	60	0.29	0.17653	0.001839	11.3432	0.22805	0.46911	0.0073972	0.78433	2610	21	2552	19	2480	32	6
M23-83	0.16733	97	0.4	0.18415	0.0016417	12.4196	0.21565	0.49185	0.0066856	0.78281	2681	18	2637	16	2579	29	5
M23-87	0.49373	188	0.46	0.18577	0.0013994	12.4972	0.20094	0.49008	0.0063262	0.80282	2698	16	2643	15	2571	27	6
M23-89	0.39871	54	0.77	0.17137	0.0021686	11.8706	0.24756	0.50408	0.0077117	0.73358	2565	24	2594	19	2631	33	-3
M23-90	0.3011	119	0.65	0.17683	0.0012859	11.473	0.18497	0.47164	0.0058336	0.7672	2620	17	2562	15	2491	26	6
M23-91	0.15276	97	0.42	0.18452	0.0016198	13.6277	0.22709	0.53706	0.0069539	0.77701	2690	17	2724	16	2771	29	-4
M23-92	0.18552	107	0.37	0.18128	0.0014883	12.2363	0.20761	0.49121	0.0066667	0.79993	2659	17	2623	16	2576	29	4
M29A-1	0.43629	120	0.21	0.17578	0.001059	11.8497	0.14346	0.48529	0.0046503	0.79152	2626	12	2593	11	2550	20	3
M29A-2	0.43327	406	0.65	0.17684	0.00068823	12.2842	0.12732	0.49943	0.0042668	0.82428	2638	10	2626	10	2611	18	1
M29A-3	0.74185	265	0.55	0.18267	0.00090056	12.424	0.16166	0.48838	0.00533	0.83875	2694	12	2637	12	2564	23	6
M29A-4	0.28452	99	0.35	0.1805	0.00094699	12.7633	0.15144	0.50931	0.0049943	0.82642	2669	11	2662	11	2654	21	1
M29A-5	0.21878	73	0.4	0.18539	0.0009976	13.1254	0.14249	0.51106	0.004434	0.79917	2709	11	2689	10	2661	19	2
M29A-6	1.5441	53	0.3	0.18045	0.0010948	12.1695	0.13698	0.48787	0.0042267	0.76967	2661	12	2618	11	2561	18	5
M29A-7	0.21933	218	0.08	0.1839	0.00081472	13.3816	0.13921	0.52632	0.0045864	0.83767	2693	9	2707	10	2726	19	-2
M29A-8	0.26415	170	0.35	0.17674	0.00086262	12.7137	0.14543	0.51967	0.0049867	0.83891	2629	10	2659	11	2698	21	-3
M29A-9	0.66368	144	0.48	0.17993	0.00093323	12.6926	0.14527	0.50901	0.0046275	0.79431	2661	12	2657	11	2652	20	0
M29A-10	0.31236	82	0.23	0.1828	0.0010445	13.0556	0.16334	0.51856	0.0053804	0.82934	2677	12	2684	12	2693	23	-1
M29A-11	0.344	63	0.16	0.17713	0.0012192	12.0021	0.1618	0.49379	0.0053798	0.80818	2618	13	2605	13	2587	23	1
M29A-12	0.47519	193	0.43	0.18	0.00093273	12.4876	0.17199	0.50744	0.0060669	0.86807	2639	11	2642	13	2646	26	0
M29A-13	0.2495	73	0.62	0.18021	0.0011492	12.7936	0.16559	0.52093	0.0055023	0.81603	2635	12	2665	12	2703	23	-3
M29A-14	0.29244	46	0.27	0.18491	0.0017573	13.8121	0.19522	0.54796	0.0051857	0.66958	2679	17	2737	13	2817	22	-6
M29A-15	0.76344	69	0.26	0.18166	0.0012514	10.8968	0.139	0.43851	0.0041578	0.7433	2655	14	2514	12	2344	19	14
M29A-16	0.3716	277	0.77	0.17881	0.00075594	12.2201	0.14015	0.49877	0.0042569	0.74417	2631	13	2621	11	2609	18	1
M29B-1	0.23562	812	0.17	0.18042	0.00072631	12.9535	0.14706	0.51468	0.0048275	0.82618	2676	11	2676	11	2677	21	0
M29B-3	0.22898	280	0.64	0.18065	0.00084751	13.0003	0.14291	0.51667	0.0044687	0.78676	2676	11	2680	10	2685	19	0

17JAM002 - McKim Formation - McKim Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb / 238U	Sig1	%Disc
M29B-4	0.18829	268	0.48	0.18541	0.00075401	13.0984	0.15598	0.50796	0.004939	0.81648	2716	11	2687	11	2648	21	3
M29B-5	0.25747	349	0.69	0.18611	0.00087105	12.785	0.15838	0.49582	0.0051552	0.83931	2716	11	2664	12	2596	22	5
M29B-6	0.5388	330	0.36	0.17914	0.00082102	12.4249	0.13784	0.50116	0.00444	0.79858	2651	11	2637	10	2619	19	1
M29B-9	0.17793	88	0.31	0.18438	0.0010883	13.29	0.17691	0.52142	0.0055064	0.79334	2697	13	2700	13	2705	23	0
M29B-10	0.32073	431	0.52	0.17796	0.00064763	12.6467	0.13136	0.51305	0.0043779	0.82153	2642	10	2654	10	2670	19	-1
M29B-11	1.2896	828	0.86	0.18075	0.00057671	12.8821	0.13764	0.51373	0.0047222	0.86032	2670	9	2671	10	2673	20	0
M29B-12	0.26567	94	0.28	0.17783	0.00098671	12.0773	0.14556	0.48879	0.0046636	0.79165	2646	12	2610	11	2565	20	4
M29B-13	0.61688	340	0.3	0.1747	0.0006681	12.0946	0.13714	0.49835	0.0048059	0.85048	2616	10	2612	11	2607	21	0
M29B-14	1.2613	743	0.89	0.17892	0.00051086	12.518	0.11388	0.50452	0.0038533	0.83953	2652	8	2644	9	2633	17	1
M29B-15	1.4554	211	0.36	0.16716	0.00084111	9.781	0.11607	0.42268	0.0041381	0.82501	2536	11	2414	11	2273	19	12
M29B-17	0.21558	707	1.44	0.18095	0.00050967	12.9514	0.12308	0.51846	0.0041579	0.8439	2664	8	2676	9	2693	18	-1
M29B-19	1.2812	581	0.76	0.17925	0.00052291	12.3109	0.12077	0.49773	0.0040845	0.83652	2647	9	2628	9	2604	18	2
M29B-20	0.31856	292	0.54	0.18281	0.0006983	12.7142	0.15101	0.50427	0.0049908	0.83325	2679	11	2659	11	2632	21	2
M29B-22	0.23527	311	0.71	0.17837	0.00049895	12.3962	0.12846	0.50537	0.0045164	0.86239	2633	9	2635	10	2637	19	0
M29B-23	5.7113	284	0.25	0.17687	0.0005764	12.1645	0.11317	0.49986	0.003887	0.83587	2620	8	2617	9	2613	17	0
M29B-24	1.1039	277	0.51	0.18074	0.00065121	12.8353	0.1202	0.51583	0.0039527	0.81822	2657	9	2668	9	2681	17	-1
M29B-25	0.54804	521	0.41	0.1789	0.00053493	12.6798	0.12962	0.51388	0.0044579	0.84864	2643	9	2656	10	2673	19	-1
M29B-26	0.45672	206	0.35	0.1813	0.00067556	12.4239	0.13497	0.49652	0.0046102	0.85465	2666	9	2637	10	2599	20	3
M29B-28	0.161	112	0.72	0.17916	0.00092713	12.8992	0.15016	0.52132	0.0047867	0.78874	2648	12	2672	11	2705	20	-3

17JAM005 - Mississagi Formation - Drury Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M23-1	0.37241	175	0.53	0.17491	0.0013037	10.9445	0.18886	0.46387	0.0060525	0.75611	2569	19	2518	16	2457	27	5
M23-2	1.4811	152	0.67	0.18475	0.0014225	12.5493	0.20495	0.50296	0.0061788	0.75221	2662	18	2646	15	2626	26	2
M23-3	0.22329	341	0.22	0.17901	0.0010627	11.8316	0.17484	0.48879	0.005655	0.78291	2611	15	2591	14	2565	24	2
M23-4	0.48289	358	0.55	0.18297	0.0011198	12.1539	0.18492	0.49062	0.0058813	0.78788	2650	16	2616	14	2573	25	3
M23-5	0.3447	182	0.79	0.18957	0.0014111	13.1966	0.24753	0.51353	0.0078997	0.82012	2710	18	2694	18	2672	34	2
M23-6	0.19986	370	0.91	0.18205	0.0012632	11.9353	0.20457	0.48233	0.0066189	0.80064	2648	17	2599	16	2537	29	5
M23-7	0.38075	198	0.92	0.1841	0.0012974	11.6146	0.17281	0.46342	0.0051737	0.75032	2669	16	2574	14	2455	23	10
M23-8	0.14518	261	0.53	0.18329	0.0011975	12.295	0.18325	0.492	0.0056605	0.77193	2664	16	2627	14	2579	24	4
M23-9	33.7842	135	0.93	0.18198	0.0014517	12.8693	0.52157	0.51792	0.020202	0.96246	2655	18	2670	38	2690	85	-2
M23-10	0.18086	93	0.55	0.21139	0.0018827	14.8849	0.26811	0.51491	0.0066561	0.71766	2903	20	2808	17	2678	28	9
M23-11	0.36687	493	0.29	0.18201	0.00098734	11.0479	0.16258	0.44062	0.0048906	0.75424	2670	16	2527	14	2353	22	14
M23-12	0.15481	121	1	0.17986	0.0015376	12.487	0.21046	0.50247	0.006315	0.74569	2655	19	2642	16	2624	27	1
M23-13	0.33785	230	0.87	0.183	0.0011139	12.7042	0.18976	0.50099	0.0058414	0.78061	2688	15	2658	14	2618	25	3
M23-14	0.171	83	0.3	0.17854	0.001813	11.7226	0.21279	0.47242	0.0061789	0.72055	2653	21	2583	17	2494	27	7
M23-15	0.55076	456	0.58	0.17995	0.00095955	12.5062	0.20415	0.49857	0.0064861	0.79695	2671	16	2643	15	2608	28	3
M23-16	0.23455	222	0.69	0.18174	0.0012225	12.3512	0.19294	0.48829	0.0056436	0.73991	2684	17	2631	15	2563	24	5
M23-17	1.4423	316	0.25	0.15564	0.0010854	8.7088	0.1301	0.40384	0.00451	0.74753	2417	17	2308	14	2187	21	11
M23-18	0.2883	259	0.42	0.1831	0.0011252	12.5921	0.18778	0.49854	0.0059022	0.79389	2682	15	2650	14	2608	25	3
M23-19	0.17984	26	0.16	0.17791	0.002635	11.7097	0.25097	0.47925	0.0066273	0.6452	2627	27	2581	20	2524	29	5
M23-22	1.7623	152	0.34	0.16293	0.0013739	8.4423	0.1441	0.37896	0.0047586	0.73567	2472	20	2280	15	2071	22	19
M23-23	0.24646	234	0.56	0.17843	0.0011443	11.5057	0.16408	0.4709	0.0049606	0.73871	2627	16	2565	13	2488	22	6
M23-24	0.19167	207	0.62	0.19276	0.0011905	14.2626	0.20182	0.53874	0.0058505	0.76746	2759	15	2767	13	2778	25	-1
M23-26	9.325	156	0.74	0.17382	0.001807	9.6702	0.17039	0.40388	0.0050845	0.71449	2593	20	2404	16	2187	23	18
M23-28	0.53523	147	0.42	0.18182	0.0012294	12.2249	0.19344	0.48664	0.0060402	0.78439	2673	16	2622	15	2556	26	5
M23-29	0.18248	465	0.82	0.17994	0.00076321	12.8185	0.19019	0.51406	0.0060325	0.79093	2661	15	2666	14	2674	26	-1
M23-30	0.15125	128	0.7	0.18735	0.0021602	11.8408	0.25557	0.45476	0.0074839	0.76246	2732	23	2592	20	2416	33	14
M23-31	0.16564	387	0.82	0.18664	0.0010186	13.3169	0.18013	0.51342	0.0052569	0.75695	2726	15	2702	13	2671	22	2
M23-32	0.16913	163	0.3	0.18213	0.0012117	12.8296	0.18479	0.50692	0.0055277	0.7571	2685	16	2667	14	2643	24	2
M23-35	0.15	41	0.37	0.1973	0.0020474	15.0323	0.27317	0.5483	0.0072054	0.72315	2817	20	2817	17	2818	30	0
M23-36	0.19094	144	0.3	0.17574	0.0011426	11.4095	0.18026	0.46723	0.0055728	0.75492	2626	17	2557	15	2471	24	7
M23-37	0.209	162	1.01	0.1804	0.0012299	11.6157	0.16591	0.46258	0.0046903	0.70988	2672	17	2574	13	2451	21	10
M23-38	0.15217	71	0.31	0.17866	0.0015016	12.5543	0.18912	0.50436	0.0052322	0.68865	2658	18	2647	14	2632	22	1
M23-39	0.16622	234	0.44	0.18735	0.0010893	13.4202	0.18536	0.51367	0.0053038	0.74754	2738	15	2710	13	2672	23	3
M23-40	0.79266	662	0.6	0.18102	0.00080024	12.6919	0.16741	0.50231	0.0048851	0.73732	2683	15	2657	12	2624	21	3
M23-41	0.15377	164	1.13	0.18094	0.0011714	13.0507	0.20858	0.51628	0.0060285	0.73061	2683	18	2683	15	2683	26	0
M23-42	4.403	152	0.43	0.17673	0.0014785	11.3032	0.18098	0.44553	0.0046808	0.65615	2689	20	2548	15	2375	21	14
M23-44	0.24001	199	0.48	0.18062	0.00095239	14.0165	0.19104	0.52624	0.00535	0.74593	2769	15	2751	13	2726	23	2
M23-45	0.149	47	0.26	0.18758	0.001481	16.3782	0.24919	0.57593	0.006567	0.74944	2876	16	2899	15	2932	27	-2
M23-46	0.1575	62	0.31	0.18749	0.0011788	16.5317	0.21663	0.56529	0.0056921	0.7684	2922	14	2908	13	2888	23	1
M23-48	0.16623	15	0.25	0.22604	0.0024678	23.7891	0.42114	0.65526	0.0083704	0.72158	3267	19	3260	17	3249	33	1
M23-49	0.15609	37	0.36	0.18408	0.0011749	18.1313	0.25957	0.58569	0.0069406	0.82775	3013	13	2997	14	2972	28	2
M23-50	2.0238	25	0.5	0.40841	0.0024521	77.9061	1.3057	1.1253	0.01693	0.89764	4247	11	4435	17	4860	51	-21

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M23-51	0.43233	61	0.28	0.17021	0.0013794	12.3141	0.17519	0.42335	0.0046553	0.77294	2913	15	2629	13	2276	21	26
M23-52	1.3486	64	0.22	0.18935	0.00080324	18.324	0.18091	0.5617	0.0044832	0.80842	3097	9	3007	10	2874	19	9
M23-53	0.12933	8	0.35	0.2209	0.0019102	27.4887	0.41638	0.71641	0.0083573	0.77012	3353	15	3401	15	3483	31	-5
M23-54	1.2392	48	0.11	0.1892	0.00089535	20.2652	0.2296	0.61813	0.0057994	0.82809	3105	10	3104	11	3102	23	0
M23-56	0.23108	27	0.46	0.17943	0.0012453	18.1636	0.23337	0.59042	0.00594	0.78304	3003	13	2998	12	2991	24	1
M23-57	0.20835	17	0.34	0.17613	0.0014648	17.1312	0.23516	0.57328	0.0057879	0.73548	2957	15	2942	13	2921	24	1
M23-58	0.16038	12	0.34	0.18733	0.0017953	19.4858	0.30299	0.61948	0.0069889	0.72556	3039	17	3066	15	3108	28	-3
M23-59	0.136	13	0.29	0.21998	0.0021786	25.7427	0.44641	0.70415	0.0092144	0.75462	3278	18	3337	17	3436	35	-6
M23-60	0.7581	60	0.36	0.17985	0.0010058	15.7608	0.39859	0.53006	0.0128	0.95485	2949	12	2862	24	2742	54	9
M23-61	0.14722	36	0.46	0.17849	0.0010227	18.8423	0.26918	0.63693	0.0078156	0.85894	2940	12	3034	14	3177	31	-10
M23-63	0.29435	43	0.46	0.1759	0.001111	16.2611	0.18918	0.55637	0.0048548	0.75003	2921	12	2892	11	2852	20	3
M23-64	0.26442	41	0.45	0.16982	0.0011891	14.2112	0.2129	0.50239	0.0062404	0.82912	2868	14	2764	14	2624	27	10
M23-66	0.16133	18	0.39	0.22178	0.001966	25.6201	0.38717	0.69179	0.007692	0.73578	3298	16	3332	15	3389	29	-4
M23-68	0.3646	92	0.22	0.17456	0.0010013	14.8655	0.18952	0.50962	0.0051918	0.79908	2918	12	2807	12	2655	22	11
M23-69	0.20137	98	0.35	0.18085	0.00085494	18.0395	0.18281	0.59886	0.0046513	0.76643	2969	10	2992	10	3025	19	-2
M23-70	0.20432	365	0.13	0.1908	0.0008715	18.7976	0.23069	0.59338	0.0062644	0.86024	3050	10	3031	12	3003	25	2
M23-71	0.31657	39	0.24	0.19755	0.0014704	18.3194	0.28277	0.56033	0.0071379	0.82531	3101	14	3007	15	2868	29	9
M23-72	0.14472	22	0.49	0.22293	0.0016776	26.2612	0.39639	0.71406	0.0085812	0.79617	3287	14	3356	15	3474	32	-7
M23-73	0.26383	56	0.44	0.16988	0.0011149	15.9025	0.23443	0.55911	0.0068589	0.83217	2877	13	2871	14	2863	28	1
M23-74	0.1735	73	0.32	0.17863	0.0010817	18.9556	0.23859	0.62805	0.0062614	0.79207	2973	12	3040	12	3142	25	-7
M23-75	0.27078	158	0.35	0.18447	0.00072635	20.6055	0.22942	0.65507	0.0059962	0.82215	3039	10	3120	11	3248	23	-9
M23-76	0.6617	34	0.31	0.17954	0.0010409	21.54	0.28119	0.69709	0.0071749	0.78845	3010	13	3163	13	3410	27	-17
M23-77	7.0157	35	0.4	0.22269	0.001519	30.6679	0.41304	0.79275	0.0076732	0.71869	3366	15	3508	13	3763	28	-16
M23-78	0.171	50	0.23	0.1834	0.001001	20.937	0.27852	0.65645	0.0068181	0.78077	3061	13	3136	13	3253	27	-8
M23-79	0.21005	129	0.37	0.18219	0.00091411	20.4128	0.23618	0.64965	0.0058216	0.7745	3037	12	3111	11	3227	23	-8
M23-80	0.25314	92	0.38	0.17971	0.00095753	19.2029	0.22754	0.62473	0.0058994	0.79692	3002	11	3052	11	3129	23	-5
M23-81	0.67801	52	0.19	0.17741	0.0011542	18.4678	0.26632	0.6136	0.0073438	0.82994	2968	13	3014	14	3084	29	-5
M23-82	0.13533	12	0.26	0.22277	0.0021628	26.3123	0.43795	0.70191	0.0087658	0.75032	3317	17	3358	16	3428	33	-4
M23-83	0.38662	59	0.26	0.18154	0.0013049	17.7506	0.2526	0.58686	0.0064923	0.77739	2976	14	2976	14	2977	26	0
M23-84	0.63548	72	0.15	0.16858	0.0012765	13.9606	0.21297	0.49749	0.0059059	0.7782	2855	16	2747	14	2603	25	11
M23-85	0.14014	66	0.25	0.18746	0.0014013	18.7328	0.27916	0.60087	0.0065653	0.7332	3025	16	3028	14	3033	26	0
M23-86	0.15749	28	0.26	0.1869	0.0019972	18.8596	0.34821	0.60731	0.0077114	0.68772	3018	21	3035	18	3059	31	-2
M23-87	0.14935	54	0.58	0.21965	0.0019226	25.3194	0.46619	0.69439	0.0091086	0.71242	3273	20	3321	18	3399	35	-5
M23-88	1.4275	171	0.6	0.1814	0.0011385	18.0296	0.30183	0.59886	0.0074512	0.74323	2969	18	2991	16	3025	30	-2
M23-89	0.14906	119	0.36	0.19143	0.0012206	19.4435	0.29466	0.61153	0.0069494	0.74985	3056	16	3064	15	3076	28	-1
M23-90	0.14849	67	0.29	0.17871	0.0012701	16.9977	0.23723	0.57227	0.0057618	0.7214	2947	16	2935	13	2917	24	1
M23-92	0.14985	103	0.5	0.18623	0.0011344	18.7389	0.25423	0.60496	0.0063937	0.77902	3014	14	3028	13	3050	26	-1
M23-93	0.15314	26	0.54	0.22153	0.0019475	24.9568	0.39944	0.67685	0.0080622	0.74421	3291	17	3307	16	3332	31	-2
M23-94	0.15	100	0.49	0.18448	0.0011543	18.1067	0.24984	0.5915	0.0064479	0.79002	2995	14	2995	13	2996	26	0
M23-95	0.26909	49	0.47	0.17104	0.0012956	15.7612	0.23654	0.55639	0.0064545	0.77296	2870	15	2862	14	2852	27	1
M23-97	0.15028	65	0.31	0.18332	0.0013272	18.3586	0.27831	0.60584	0.0071042	0.77351	2979	15	3009	15	3053	28	-3
M23-98	0.24853	268	0.56	0.18409	0.0008629	18.1591	0.24503	0.59788	0.006211	0.76987	2983	14	2998	13	3021	25	-2
M23-100	0.15614	53	0.58	0.21923	0.0016431	25.2889	0.41172	0.70047	0.0082539	0.72375	3258	18	3319	16	3422	31	-7

17JAM005 - Mississagi Formation - Drury Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M23-102	0.26065	81	0.42	0.18329	0.0014121	14.1448	0.22244	0.46887	0.0051635	0.70028	2972	18	2759	15	2479	23	20
M23-103	1.0106	128	0.25	0.18043	0.0012544	17.6657	0.26413	0.59406	0.0067087	0.75529	2949	16	2972	14	3006	27	-2
M23-106	0.633	157	0.48	0.18557	0.0011051	16.3744	0.22086	0.53463	0.0056049	0.77726	2996	14	2899	13	2761	24	10
M23-107	0.24944	67	0.26	0.17415	0.001224	14.7937	0.22506	0.514	0.0062677	0.80154	2896	15	2802	14	2674	27	9
M23-108	0.163	34	0.58	0.22212	0.0018193	24.0357	0.37421	0.65386	0.0076562	0.7521	3286	16	3270	15	3243	30	2
M23-109	0.15641	61	0.19	0.18954	0.0013774	19.4266	0.29427	0.61445	0.0074182	0.79701	3047	15	3063	15	3088	30	-2
M23-110	0.15158	78	0.46	0.18688	0.0011908	18.7002	0.24283	0.59797	0.0060117	0.77421	3030	13	3026	13	3022	24	0
M23-111	0.17947	63	0.84	0.18093	0.0012126	17.9877	0.22009	0.59216	0.005215	0.71978	2983	14	2989	12	2998	21	-1
M23-112	0.13724	150	0.5	0.17838	0.00092508	18.8725	0.2401	0.62811	0.0063782	0.79819	2965	12	3035	12	3142	25	-8
M23-113	0.15996	36	1.03	0.22157	0.0014505	25.9065	0.36619	0.69186	0.0074548	0.76229	3315	14	3343	14	3390	28	-3
M23-115	0.16843	97	0.55	0.18444	0.0011292	18.6696	0.27548	0.59939	0.0071304	0.8062	3023	14	3025	14	3027	29	0
M23-117	0.17476	74	0.47	0.20113	0.0012175	21.7292	0.27319	0.64231	0.006187	0.76616	3155	13	3172	12	3198	24	-2
M23-118	0.3042	36	0.36	0.18221	0.0015579	17.3409	0.24228	0.56807	0.0056281	0.70911	2991	16	2954	13	2900	23	4
M23-120	0.17793	57	0.08	0.1803	0.0012947	17.4829	0.22665	0.58108	0.0055729	0.73977	2968	14	2962	12	2953	23	1
M23-121	0.15675	26	0.58	0.21944	0.0016692	25.0333	0.35357	0.68632	0.0072422	0.74712	3274	15	3310	14	3369	28	-4
M23-122	0.15662	20	0.18	0.18197	0.0017131	17.657	0.28416	0.58664	0.0070858	0.75053	2968	17	2971	15	2976	29	0
M23-125	0.5967	55	0.34	0.17162	0.001064	16.1129	0.20044	0.56788	0.0055361	0.78367	2873	13	2884	12	2899	23	-1
M23-127	0.15733	19	0.45	0.17975	0.0017398	17.7867	0.26901	0.59881	0.0063822	0.70473	2947	17	2978	14	3025	26	-3
M23-128	0.12283	19	0.42	0.19226	0.001641	19.576	0.28045	0.61648	0.0063884	0.72332	3054	16	3071	14	3096	25	-2
M23-129	0.15406	12	0.28	0.22266	0.0018474	26.5997	0.41948	0.72365	0.0088018	0.77127	3286	16	3369	15	3510	33	-9
M29B-1	2.4785	428	0.75	0.19032	0.00065746	13.1406	0.13355	0.50303	0.0042005	0.82166	2737	10	2690	10	2627	18	5
M29B-2	1.6277	631	0.36	0.18199	0.00052222	12.186	0.1219	0.48914	0.0041979	0.85792	2659	9	2619	9	2567	18	4
M29B-3	0.2059	191	0.17	0.19544	0.00075802	13.7461	0.13819	0.51516	0.0042614	0.82282	2772	9	2732	10	2679	18	4
M29B-4	0.38915	223	0.39	0.18244	0.00066464	12.2474	0.12834	0.49301	0.0043177	0.83578	2654	10	2624	10	2584	19	3
M29B-6	0.14832	176	0.49	0.18318	0.00077901	12.5906	0.14304	0.50612	0.0046974	0.81698	2657	11	2650	11	2640	20	1
M29B-7	0.31593	76	0.43	0.17725	0.0010616	11.0422	0.13392	0.4591	0.0042929	0.77102	2601	13	2527	11	2436	19	8
M29B-8	2.1463	103	0.75	0.18384	0.000855	12.5132	0.1327	0.50071	0.0042494	0.80027	2664	11	2644	10	2617	18	2
M29B-9	0.17933	40	0.35	0.18403	0.001237	12.7013	0.15547	0.50681	0.0047259	0.76183	2669	13	2658	12	2643	20	1
M29B-10	0.25008	357	0.42	0.18116	0.00062644	12.8104	0.1353	0.51832	0.0046109	0.84228	2646	9	2666	10	2692	20	-2
M29B-11	47.4863	110	0.16	0.20378	0.0012456	13.3405	0.17555	0.47898	0.0049928	0.79211	2842	13	2704	12	2523	22	14
M29B-12	0.22527	57	0.4	0.1857	0.0012217	12.989	0.16305	0.51112	0.00487	0.75902	2692	13	2679	12	2661	21	1
M29B-13	0.19301	85	0.63	0.18334	0.001099	12.321	0.14856	0.49119	0.0045999	0.77668	2671	13	2629	11	2576	20	4
M29B-14	0.21847	159	0.45	0.18554	0.00082534	12.7765	0.1316	0.50345	0.0039871	0.76889	2690	11	2663	10	2629	17	3
M29B-15	0.25056	341	0.9	0.18211	0.0011237	11.2475	0.14925	0.45166	0.0047161	0.78689	2658	14	2544	12	2403	21	12
M29B-16	0.41034	480	0.77	0.18414	0.00064627	13.0174	0.15501	0.51712	0.0049478	0.80349	2676	12	2681	11	2687	21	0
M29B-17	0.30485	153	0.97	0.17773	0.00079925	11.201	0.12509	0.46059	0.0038686	0.7521	2619	12	2540	10	2442	17	8
M29B-18	0.33281	154	0.76	0.1838	0.00092496	11.8148	0.12911	0.46922	0.0039197	0.76444	2677	12	2590	10	2480	17	9
M29B-19	0.20795	226	0.4	0.18844	0.0008099	13.3299	0.14302	0.51574	0.0044678	0.80743	2720	10	2703	10	2681	19	2
M29B-21	0.20681	92	0.31	0.2002	0.0011641	15.0766	0.18685	0.54839	0.0053143	0.78195	2821	13	2820	12	2818	22	0
M29B-23	0.19844	109	0.36	0.19462	0.0011386	13.757	0.16275	0.51266	0.0047047	0.77572	2782	12	2733	11	2668	20	5
M29B-24	0.20851	104	0.46	0.18779	0.00081145	13.0067	0.13503	0.50162	0.0042408	0.81434	2725	10	2680	10	2621	18	5
M29B-25	0.17714	64	0.37	0.18566	0.00098412	12.9722	0.13957	0.50532	0.0042651	0.78447	2709	11	2678	10	2637	18	3

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M29B-26	0.19015	104	0.27	0.18685	0.00078292	13.7664	0.14905	0.53208	0.004811	0.83509	2722	10	2734	10	2750	20	-1
M29B-27	1.6907	104	0.31	0.19117	0.00087462	14.4175	0.16511	0.54387	0.0051044	0.81952	2762	11	2778	11	2800	21	-2
M29B-28	0.14556	54	0.42	0.18184	0.00099504	12.8925	0.15283	0.51116	0.004842	0.79909	2680	12	2672	11	2662	21	1
M29B-29	0.17857	66	0.32	0.18596	0.00095937	13.3081	0.14429	0.51654	0.0044865	0.80111	2715	11	2702	10	2684	19	1
M29B-30	0.19237	58	0.57	0.1932	0.0010036	14.6962	0.15852	0.54967	0.0048026	0.81	2776	10	2796	10	2824	20	-2
M29B-31	2.6431	80	0.26	0.19334	0.00095323	13.6877	0.13688	0.51216	0.0040414	0.78906	2775	10	2728	9	2666	17	5
M29B-32	0.35579	76	0.43	0.18009	0.00094045	11.7798	0.14201	0.47373	0.0047697	0.83518	2656	11	2587	11	2500	21	7
M29B-33	0.20349	90	0.48	0.18302	0.00093867	12.9772	0.14429	0.51444	0.0046843	0.81897	2680	11	2678	10	2676	20	0
M29B-34	0.22186	127	0.53	0.18158	0.00068107	13.0292	0.12035	0.52076	0.0039523	0.82162	2666	9	2682	9	2702	17	-2
M29B-35	0.14372	38	0.46	0.18158	0.0012958	12.6863	0.14681	0.50722	0.0041763	0.71151	2666	13	2657	11	2645	18	1
M29B-36	14.8012	91	0.27	0.19228	0.00095296	13.4376	0.14495	0.50756	0.0043299	0.79086	2760	11	2711	10	2646	19	5
M29B-37	0.242	87	0.3	0.18716	0.00097871	12.9591	0.14295	0.50302	0.0041856	0.7543	2715	12	2677	10	2627	18	4
M29B-38	0.69332	151	0.54	0.18391	0.00076627	12.0504	0.1282	0.47598	0.0040271	0.79529	2686	11	2608	10	2510	18	8
M29B-39	2.1474	314	0.36	0.18852	0.00064859	13.4428	0.13036	0.51774	0.0041262	0.82185	2727	9	2711	9	2690	18	2
M29B-40	0.1898	82	0.38	0.18312	0.00091923	13.0567	0.13463	0.51748	0.0041495	0.77769	2680	11	2684	10	2688	18	0
M29B-41	1.9016	271	0.25	0.18455	0.00060056	12.0084	0.10281	0.47201	0.0031334	0.77538	2694	9	2605	8	2492	14	9
M29B-42	0.82406	79	0.42	0.17981	0.0010199	12.4894	0.18525	0.50365	0.0064433	0.8625	2651	12	2642	14	2629	28	1
M29B-43	0.31481	266	0.37	0.17914	0.00060713	12.8127	0.12236	0.51822	0.0040881	0.82602	2647	9	2666	9	2692	17	-2
M29B-44	0.47166	122	0.6	0.18558	0.00077682	11.6759	0.11152	0.45577	0.0035161	0.8077	2705	9	2579	9	2421	16	13
M29B-46	0.26771	61	0.49	0.18115	0.00094662	12.1651	0.12414	0.4864	0.003855	0.77667	2666	11	2617	10	2555	17	5
M29B-47	0.29511	93	0.56	0.1763	0.00078218	11.5593	0.11169	0.47484	0.0035762	0.77943	2621	10	2569	9	2505	16	5
M29B-49	0.41769	147	0.59	0.18257	0.00075046	13.37	0.14148	0.53021	0.0047211	0.84143	2679	9	2706	10	2742	20	-3
M29B-50	0.23573	52	0.18	0.2021	0.00099771	15.0588	0.14275	0.5394	0.0039297	0.76853	2846	10	2819	9	2781	16	3
M29B-51	0.18872	70	0.35	0.1846	0.00093893	13.4956	0.14192	0.52916	0.0044848	0.80595	2698	10	2715	10	2738	19	-2
M29B-52	0.1921	16	0.32	0.18338	0.0017819	12.7896	0.18504	0.50476	0.0049892	0.68318	2687	17	2664	14	2634	21	2
M29B-53	1.0823	74	0.23	0.18674	0.00091418	13.0674	0.12866	0.50709	0.003771	0.7553	2715	11	2685	9	2644	16	3
M29B-54	0.16523	128	0.34	0.18302	0.00088448	12.8851	0.13069	0.51052	0.0039759	0.76785	2681	11	2671	10	2659	17	1
M29B-55	0.17368	52	0.35	0.18585	0.0012663	13.0507	0.15986	0.50954	0.004564	0.73123	2705	14	2683	12	2655	19	2
M29B-56	0.19571	134	0.51	0.18054	0.00088162	12.6066	0.14634	0.50705	0.0045257	0.76893	2656	12	2651	11	2644	19	1
M29B-57	0.39606	98	0.29	0.18349	0.00125	12.8491	0.18375	0.50884	0.0054742	0.75229	2682	16	2669	13	2652	23	1
M29B-58	0.18	373	0.66	0.18265	0.00073672	13.0264	0.15463	0.51851	0.0048319	0.78505	2673	12	2682	11	2693	21	-1
M29B-59	0.1405	225	0.58	0.18069	0.00081165	12.7154	0.14161	0.51151	0.0045139	0.79236	2656	11	2659	10	2663	19	0
M29B-60	1.2266	275	0.64	0.17557	0.00073089	11.6729	0.12186	0.4832	0.0040519	0.80326	2608	10	2579	10	2541	18	3
M29B-61	0.35344	88	0.46	0.18286	0.001057	12.8864	0.16306	0.51206	0.0051925	0.80136	2676	13	2671	12	2665	22	0
M29B-63	1.1618	200	0.34	0.19149	0.0008993	8.3711	0.088925	0.31647	0.0026597	0.79114	2758	11	2272	10	1772	13	41
M29B-64	0.34173	409	0.7	0.17826	0.00053845	12.6503	0.12248	0.51283	0.0042017	0.84621	2643	9	2654	9	2669	18	-1
M29B-65	0.2135	181	0.67	0.18002	0.00076136	12.6046	0.12814	0.50506	0.0041613	0.81044	2662	10	2651	10	2635	18	1
M29B-66	0.21192	100	0.77	0.18185	0.00080371	12.9271	0.13481	0.51187	0.0042443	0.79511	2682	10	2674	10	2665	18	1
M29B-67	0.22058	106	1.13	0.17875	0.0010071	12.8411	0.15421	0.51634	0.0047968	0.77359	2656	13	2668	11	2684	20	-1
M29B-69	0.27756	230	0.47	0.182	0.00064302	13.1361	0.13526	0.51897	0.0042903	0.80286	2685	10	2689	10	2695	18	0
M29B-70	0.83755	444	0.62	0.17964	0.00061295	13.1294	0.12888	0.52663	0.0042392	0.82003	2660	9	2689	9	2727	18	-3
M29B-71	0.32188	236	0.89	0.17998	0.00069008	12.6938	0.12755	0.50931	0.0041828	0.81733	2660	10	2657	9	2654	18	0
M29B-72	0.48652	81	0.68	0.18069	0.00094713	12.5081	0.1355	0.50095	0.004132	0.76142	2663	12	2643	10	2618	18	2

17JAM005 - Mississagi Formation - Drury Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M29B-74	1.4027	665	1.79	0.17697	0.00058022	12.0193	0.12183	0.49255	0.0039117	0.7835	2625	10	2606	10	2582	17	2
M29B-75	0.299	253	0.61	0.18963	0.00069654	13.6989	0.13677	0.52467	0.0041861	0.79913	2737	10	2729	9	2719	18	1
M29B-77	0.299	130	0.54	0.19637	0.00088821	14.7981	0.15448	0.54715	0.0046047	0.80619	2794	10	2802	10	2813	19	-1
M29B-78	1.8994	128	0.36	0.17233	0.00089748	10.1398	0.10654	0.42706	0.0035173	0.78382	2579	11	2448	10	2292	16	13
M29B-79	0.29872	134	0.9	0.1826	0.00074356	12.9326	0.12897	0.51388	0.004207	0.82094	2676	9	2675	9	2673	18	0
M29B-80	1.1869	529	0.92	0.17823	0.00054383	12.4394	0.12422	0.50622	0.0042816	0.84701	2636	9	2638	9	2640	18	0
M29B-82	0.36271	167	0.52	0.18632	0.00071577	13.6339	0.15745	0.53088	0.0053041	0.86513	2709	10	2725	11	2745	22	-2
M29B-84	1.0577	172	0.82	0.17732	0.00075189	12.3555	0.12191	0.50577	0.0039667	0.79486	2627	10	2632	9	2639	17	-1
M29B-85	0.70356	156	1.01	0.17509	0.000737	10.9403	0.10675	0.4538	0.0033886	0.76529	2605	10	2518	9	2412	15	9
M29B-86	0.77186	125	0.52	0.18189	0.00091227	12.9678	0.14925	0.51807	0.0045452	0.7623	2667	12	2677	11	2691	19	-1
M29B-87	0.17037	117	0.62	0.18339	0.0011159	13.3318	0.17812	0.52854	0.0052279	0.74031	2680	15	2703	13	2735	22	-3
M29B-88	0.77181	565	0.91	0.18093	0.00071555	12.5846	0.13726	0.50438	0.0042547	0.77339	2662	11	2649	10	2633	18	1
M29B-89	0.18072	280	0.94	0.18254	0.00073675	13.3758	0.14046	0.53053	0.0043836	0.78683	2679	11	2707	10	2744	18	-3
M29B-91	0.29461	152	0.59	0.18139	0.00090578	12.626	0.14004	0.50315	0.0043057	0.77152	2671	12	2652	10	2627	18	2
M29B-93	0.81088	200	0.66	0.18076	0.00072184	12.5842	0.13002	0.50244	0.0039282	0.75668	2668	11	2649	10	2624	17	2
M29B-94	0.18242	118	0.62	0.18043	0.00097337	12.5118	0.13801	0.49766	0.0040855	0.74424	2674	12	2644	10	2604	18	3
M29B-95	0.19678	109	0.56	0.18511	0.0010535	13.3661	0.15294	0.51613	0.0045895	0.77713	2723	12	2706	11	2683	20	2
M29B-96	2.1954	1094	0.85	0.18095	0.00064537	12.6397	0.12025	0.49727	0.0036688	0.77552	2692	10	2653	9	2602	16	4
M29B-97	0.47113	236	0.95	0.18223	0.00085525	12.3764	0.12726	0.48385	0.0038895	0.78175	2703	11	2633	10	2544	17	7
M29B-99	0.17991	161	0.54	0.21476	0.00084855	17.1079	0.15869	0.56891	0.0040856	0.77419	2967	9	2941	9	2903	17	3
M29B-100	0.19124	74	0.38	0.19705	0.00097175	15.1073	0.17053	0.54884	0.0048698	0.78607	2823	11	2822	11	2820	20	0

17JAM009 - Matinenda Formation - Drury Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M29A-4	0.32461	359	0.67	0.18061	0.00078468	12.4229	0.15123	0.49631	0.0049487	0.81906	2667	12	2637	11	2598	21	3
M29A-10	1.4145	503	0.14	0.18081	0.00072159	13.2012	0.15224	0.52562	0.0050021	0.82521	2673	11	2694	11	2723	21	-2
M29A-15	0.83597	339	0.99	0.2251	0.0012101	15.3704	0.18601	0.49045	0.0046177	0.77802	3033	12	2838	12	2573	20	18
M29A-18	0.28933	186	1.08	0.1849	0.0010007	12.6961	0.17822	0.49206	0.0056228	0.81404	2717	13	2657	13	2580	24	6
M29A-20	3.3822	236	1.02	0.21251	0.0010553	13.3645	0.16984	0.4501	0.0045485	0.79518	2946	12	2706	12	2396	20	22
M29A-21	1.9444	297	1.89	0.1994	0.0010255	13.2359	0.15458	0.47556	0.0043665	0.78618	2841	12	2697	11	2508	19	14
M29A-22	0.46702	530	0.74	0.18985	0.0012179	13.289	0.17161	0.502	0.0050565	0.78002	2759	13	2700	12	2622	22	6
M29A-27	0.43679	314	0.66	0.17881	0.00098593	12.4723	0.16154	0.50075	0.0051835	0.79923	2659	13	2641	12	2617	22	2
M29A-28	1.9669	542	0.87	0.21219	0.0011378	13.8945	0.19636	0.47222	0.0056794	0.85103	2932	12	2743	13	2493	25	18
M29A-29-k	1.396	224	2.11	0.21694	0.0017793	14.5921	0.21312	0.48593	0.0053827	0.75847	2964	15	2789	14	2553	23	17
M29A-30	2.2467	352	0.58	0.18935	0.0010704	11.4656	0.15635	0.4382	0.0049943	0.83581	2740	12	2562	13	2343	22	17
M29A-32-c	0.80387	301	0.58	0.2359	0.0013771	15.6839	0.19671	0.48197	0.0046894	0.77576	3093	13	2858	12	2536	20	22
M29A-33-r	0.20826	132	0.59	0.18631	0.0011851	13.4263	0.19429	0.52333	0.0060175	0.79461	2708	14	2710	14	2713	25	0
M29A-34	0.69826	312	0.55	0.18282	0.0010675	12.8107	0.17764	0.5091	0.0056394	0.79883	2676	14	2666	13	2653	24	1
M29A-39-k	7.4023	968	0.63	0.20049	0.001268	11.9084	0.14689	0.43101	0.0039468	0.74234	2829	13	2597	12	2310	18	22
M29A-40	1.3837	849	1.3	0.2089	0.0015866	15.028	0.2027	0.52137	0.005141	0.73106	2898	15	2817	13	2705	22	8
M29A-44-c	1.1794	356	0.63	0.21552	0.0018327	16.6014	0.22575	0.55756	0.0050169	0.66169	2951	16	2912	13	2857	21	4
M29A-46	1.6924	505	0.73	0.19777	0.001329	13.7315	0.19357	0.50193	0.0052965	0.74854	2813	15	2731	13	2622	23	8
M29A-49	0.66726	486	0.25	0.18285	0.00087501	13.1449	0.16379	0.51797	0.0051669	0.80056	2690	12	2690	12	2691	22	0
M29A-50	0.89807	427	0.18	0.19253	0.00091716	13.955	0.15526	0.5217	0.0045426	0.78261	2776	11	2747	11	2706	19	3
M29A-51	0.34917	350	0.43	0.18872	0.0010134	13.5988	0.16216	0.51811	0.0049694	0.80436	2745	12	2722	11	2691	21	2

17JAM009 - Matinenda Formation - Drury Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	RhoXY	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	%Disc
M29A-55	0.43281	870	0.08	0.182	0.00081707	13.3393	0.16375	0.52588	0.0054133	0.83855	2689	11	2704	12	2724	23	-2
M29A-60	0.171778	252	0.24	0.18048	0.00096159	13.3212	0.15951	0.5303	0.0050663	0.79825	2674	12	2703	11	2742	21	-3
M29A-61	1.3127	658	0.67	0.20278	0.0014126	15.3029	0.18969	0.54296	0.0049971	0.74245	2862	13	2834	12	2796	21	3
M29A-64-h	1.9302	1526	0.19	0.18455	0.001192	13.4756	0.1761	0.52634	0.0054431	0.79135	2704	13	2714	12	2726	23	-1
M29A-67-k	1.0197	297	2.17	0.25367	0.0016733	16.8515	0.23098	0.47977	0.0051618	0.78494	3214	13	2926	13	2526	22	26
M29A-69	0.95116	670	1.21	0.22263	0.0018535	15.681	0.23951	0.50965	0.0056782	0.72945	3004	17	2858	15	2655	24	14
M29A-70	0.64138	823	0.27	0.18215	0.00093225	13.2255	0.17848	0.52545	0.0058324	0.82249	2676	13	2696	13	2722	25	-2
M29A-74	0.22017	274	2.01	0.17956	0.00094493	13.1068	0.1788	0.52778	0.0060376	0.83859	2654	12	2687	13	2732	25	-4
M29A-76	1.9981	292	1.59	0.24176	0.0015525	15.4658	0.20435	0.46214	0.0047747	0.78195	3138	13	2844	13	2449	21	26
M29A-78	0.43832	644	0.3	0.17933	0.00083051	13.3246	0.17337	0.53631	0.0058235	0.83456	2655	12	2703	12	2768	24	-5
M29A-79	1.9084	203	1.1	0.18769	0.0010034	12.5004	0.16217	0.48029	0.0048541	0.77906	2731	13	2643	12	2529	21	9
M29A-D1	0.45088	858	0.3	0.18857	0.0010357	12.9832	0.17883	0.50285	0.0056503	0.81576	2718	13	2678	13	2626	24	4
M29A-D2	0.92032	2340	0.07	0.18321	0.0007607	13.8856	0.16244	0.5523	0.0051667	0.79968	2674	12	2742	11	2835	21	-7
M29A-D3	0.26857	339	0.35	0.17976	0.00096467	12.68	0.16905	0.51285	0.0054438	0.79617	2647	13	2656	13	2669	23	-1
M29A-D4	0.84063	448	0.68	0.1938	0.0012942	13.985	0.19371	0.52347	0.0052701	0.72683	2774	16	2749	13	2714	22	3
M29A-D5	0.36642	683	1.38	0.18412	0.001165	13.2574	0.1995	0.52112	0.0058346	0.74405	2694	17	2698	14	2704	25	0
M29A-D6	4.3762	1890	0.04	0.18164	0.00093845	13.7819	0.20964	0.54723	0.0066218	0.7955	2677	15	2735	14	2814	28	-6
M29A-D7	1.6265	1506	0.15	0.18727	0.0011095	13.6758	0.17961	0.52605	0.0051523	0.74574	2730	14	2728	12	2725	22	0
M29A-D8	0.41053	238	0.89	0.1891	0.0012867	13.5996	0.18495	0.51745	0.005358	0.76139	2747	14	2722	13	2688	23	3
M29A-D9	0.194	162	1.41	0.19423	0.0023031	13.6128	0.27177	0.50366	0.007634	0.75922	2793	21	2723	19	2629	33	7
M29A-D11	0.22609	511	0.63	0.18049	0.0011669	12.7705	0.17857	0.50785	0.0056043	0.78917	2675	14	2663	13	2647	24	1
M29A-D12	0.18133	689	0.06	0.18077	0.0010388	13.1943	0.16781	0.52482	0.0052421	0.78536	2674	13	2694	12	2720	22	-2
M29A-D14	0.75996	975	0.16	0.18659	0.0010523	13.7239	0.17216	0.52962	0.0051753	0.77895	2724	13	2731	12	2740	22	-1
M29A-D15	0.51567	1008	0.09	0.18036	0.0010237	13.2011	0.17618	0.52783	0.0055226	0.78396	2666	14	2694	13	2732	23	-3
M29A-D16	0.24758	290	0.61	0.18465	0.0011431	13.244	0.18998	0.518	0.0056626	0.76207	2702	15	2697	14	2691	24	1
M29A-D18	0.53755	1165	0.05	0.18038	0.0010078	13.4141	0.19308	0.53786	0.0056771	0.73329	2661	16	2709	14	2774	24	-5
M29A-D19	0.48262	320	0.77	0.18363	0.001138	13.3715	0.19679	0.52544	0.0056428	0.7297	2694	17	2706	14	2722	24	-1
M29A-D20	1.4117	530	0.81	0.18002	0.0011014	12.6312	0.18394	0.50438	0.0056625	0.77095	2668	15	2653	14	2633	24	2
M29A-D21	0.68747	344	0.86	0.19606	0.001783	13.7359	0.27255	0.5017	0.008204	0.82414	2814	18	2732	19	2621	35	8
M29A-D22	0.21922	633	1.62	0.1779	0.0010809	13.1843	0.19207	0.5287	0.0059627	0.77415	2661	15	2693	14	2736	25	-3
M29A-D24	0.15509	414	1.4	0.17909	0.00081148	13.3904	0.18589	0.53135	0.0055682	0.75488	2678	15	2708	13	2747	23	-3
M29A-D25	0.55088	301	0.73	0.1834	0.00096046	13.0267	0.18842	0.50471	0.0057291	0.78478	2718	15	2682	14	2634	25	4
M29A-D26	1.1629	1256	0.57	0.18569	0.0010187	13.5594	0.18917	0.51982	0.0056117	0.77381	2735	15	2719	13	2698	24	2
M29A-D27	0.51938	242	1.13	0.19226	0.0011091	12.1598	0.16365	0.45108	0.0044432	0.73189	2789	15	2617	13	2400	20	17
M29A-D28	0.36265	919	1	0.17939	0.00097083	12.9564	0.18929	0.51607	0.0057191	0.75853	2672	16	2676	14	2683	24	0
M29A-D29	8.0255	1006	1.26	0.21928	0.0013013	10.5405	0.18058	0.3441	0.0046018	0.78058	2996	17	2483	16	1906	22	42
M29A-D31	0.2429	616	1.11	0.18395	0.0011059	12.9	0.22317	0.50329	0.0068929	0.79166	2706	17	2672	16	2628	30	4
M29A-D33	0.80182	1041	0.25	0.18888	0.00075152	13.5534	0.18386	0.51536	0.0054411	0.77829	2749	14	2719	13	2679	23	3
M29A-D34	0.76563	1455	1.08	0.18265	0.00088327	13.0941	0.17355	0.51525	0.0052499	0.76874	2692	14	2686	12	2679	22	1
M29A-D35	0.38047	1072	0.16	0.18674	0.00089973	13.7015	0.18055	0.52774	0.0052681	0.75753	2727	14	2729	12	2732	22	0
M29A-D36	0.5567	488	1	0.19605	0.00096398	13.5472	0.18736	0.49739	0.0050592	0.73547	2806	15	2719	13	2603	22	9
M29A-D37	0.22258	1710	0.46	0.18122	0.00065255	13.8289	0.15845	0.54838	0.00462	0.73527	2679	13	2738	11	2818	19	-6
M29A-D38	0.36926	659	0.19	0.17845	0.00078873	13.1522	0.15043	0.52904	0.0046357	0.7661	2656	12	2691	11	2737	20	-4

17JAM009 - Matinenda Formation - Drury Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M29A-D39	0.53154	565	0.09	0.18746	0.00091965	13.3769	0.14209	0.51162	0.0040404	0.74348	2739	12	2707	10	2664	17	3
M29A-D40	1.0736	326	0.55	0.21385	0.0010607	13.3342	0.1444	0.44652	0.0037254	0.77045	2955	11	2704	10	2380	17	23
M29A-D41	0.49964	184	0.75	0.2092	0.0011269	13.2231	0.14466	0.45212	0.0036757	0.74316	2922	12	2696	10	2405	16	21
M29A-D43	2.3203	411	0.64	0.24274	0.0016819	17.3786	0.23025	0.5117	0.0052486	0.77418	3161	13	2956	13	2664	22	19
M29A-D45	0.64309	366	0.17	0.17787	0.00068508	13.127	0.13828	0.52768	0.0046961	0.84483	2657	9	2689	10	2732	20	-3
M29A-D46	0.25465	938	0.05	0.17866	0.00060497	13.2404	0.1281	0.5301	0.0043497	0.8481	2663	8	2697	9	2742	18	-4
M29A-D47	0.20864	387	0.93	0.17767	0.00065857	12.8496	0.1333	0.51751	0.0045684	0.85097	2654	9	2669	10	2689	19	-2
M29A-D49	0.20909	243	0.67	0.18038	0.00072465	13.1777	0.14519	0.52296	0.0048194	0.83642	2678	10	2692	10	2712	20	-2
M29A-D50	1.0243	470	0.36	0.19383	0.00077176	13.7543	0.14581	0.50802	0.0045233	0.83988	2796	9	2733	10	2648	19	6
M29A-D51	0.37217	164	0.97	0.18335	0.00099538	12.9593	0.14536	0.50594	0.0044847	0.79027	2705	11	2677	11	2639	19	3
M29A-D52	0.3321	159	1.97	0.17674	0.00080802	12.3218	0.14911	0.49897	0.0050728	0.84012	2645	11	2629	11	2609	22	2
M29A-D54	0.29128	237	1.46	0.1923	0.00086642	14.3204	0.24338	0.53292	0.0082222	0.90783	2784	12	2771	16	2754	35	1
M29A-D55	0.29618	286	0.7	0.18079	0.00072502	13.7082	0.17956	0.54098	0.006085	0.85872	2687	11	2730	12	2788	25	-5
M29A-D58	0.47635	479	0.74	0.18404	0.00068159	13.051	0.15544	0.50447	0.0052138	0.86776	2722	10	2683	11	2633	22	4
M29A-D59	0.38897	2075	0.1	0.17775	0.00056032	13.8838	0.14564	0.55401	0.0049629	0.854	2669	9	2742	10	2842	21	-8
M29A-D60	0.73948	489	0.89	0.1909	0.00068089	13.1519	0.14436	0.48723	0.0044411	0.83044	2791	10	2691	10	2559	19	10
M29B-1	0.97998	483	0.37	0.1941	0.00054447	13.3944	0.13651	0.50108	0.0042942	0.84086	2775	9	2708	10	2618	18	7
M29B-2	0.48121	458	0.15	0.18103	0.00047364	13.203	0.1349	0.52923	0.00473	0.87476	2661	8	2694	10	2738	20	-4
M29B-3	0.24412	347	0.19	0.18136	0.00051423	13.4208	0.13942	0.53664	0.0049331	0.88491	2666	8	2710	10	2769	21	-5
M29B-4	1.6592	517	0.18	0.18578	0.00055959	12.3826	0.11233	0.48305	0.0036641	0.83614	2706	8	2634	9	2541	16	7
M29B-5	1.2009	258	0.43	0.18331	0.00058629	13.7141	0.16141	0.54184	0.0056741	0.88974	2685	9	2730	11	2791	24	-5
M29B-6	1.4058	330	0.17	0.18019	0.00052858	12.7645	0.12479	0.51261	0.0042263	0.84333	2658	9	2662	9	2668	18	0
M29B-7	0.74035	847	0.06	0.18188	0.00048913	13.2779	0.11669	0.52812	0.0037591	0.8099	2674	9	2700	8	2734	16	-3
M29B-8	16.4985	1556	0.17	0.19169	0.0006442	10.9857	0.099773	0.4145	0.0028096	0.74634	2761	10	2522	8	2235	13	22
M29B-9	12.3974	566	1.44	0.21556	0.0010405	12.0738	0.13798	0.40501	0.0034038	0.73539	2953	13	2610	11	2192	16	30
M29B-10	2.6813	1415	0.23	0.19288	0.00059287	13.3842	0.1597	0.50165	0.0044678	0.74639	2772	13	2707	11	2621	19	7
M29B-12	1.1259	431	0.81	0.20026	0.0012098	11.7907	0.14806	0.42594	0.0039081	0.73067	2832	14	2588	12	2287	18	23
M29B-13	1.1056	513	0.23	0.19546	0.00070598	13.5627	0.13358	0.50223	0.0038222	0.77274	2792	10	2720	9	2623	16	7
M29B-15	3.1554	1241	0.09	0.18434	0.00046221	13.3536	0.12548	0.52457	0.004105	0.8328	2695	9	2705	9	2719	17	-1
M29B-16	0.19141	374	0.18	0.18323	0.00058506	13.1213	0.14294	0.51884	0.0048461	0.85743	2684	9	2688	10	2694	21	0
M29B-18	3.3313	549	0.47	0.20973	0.00097151	13.0539	0.1436	0.45173	0.0040455	0.8141	2902	10	2684	10	2403	18	21
M29B-19	0.29988	324	0.46	0.1853	0.00064017	12.6157	0.12715	0.49474	0.0042149	0.84532	2698	9	2651	9	2591	18	5
M29B-20	0.58823	202	0.94	0.20593	0.0014319	12.5074	0.17129	0.4419	0.0048149	0.79561	2869	13	2643	13	2359	22	21
M29B-22	1.1815	605	1.74	0.19729	0.00074733	11.8796	0.12853	0.43866	0.0037515	0.79046	2797	11	2595	10	2345	17	19
M29B-23	0.17814	138	1.29	0.18049	0.00094234	12.5764	0.14984	0.50824	0.0047921	0.79137	2648	12	2648	11	2649	20	0
M29B-24	0.18886	1111	0.26	0.18266	0.00060732	12.7596	0.13178	0.50951	0.0043848	0.83325	2668	9	2662	10	2655	19	1
M29B-25	0.23838	737	0.07	0.18228	0.00061931	12.7456	0.12238	0.51001	0.0039508	0.80675	2664	9	2661	9	2657	17	0
M29B-27	0.51356	393	1.61	0.18746	0.00077989	12.047	0.11413	0.46873	0.0032933	0.74164	2711	10	2608	9	2478	14	10
M29B-28	0.72499	256	1.13	0.19862	0.00087941	13.2362	0.15101	0.48608	0.0043938	0.79231	2806	11	2697	11	2554	19	11

17JAM010 – Ramsay Lake Formation - Joubin Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M29A-1	0.14866	66	1.11	0.181	0.0012773	13.2595	0.19267	0.52689	0.0060536	0.79067	2676	15	2698	14	2728	26	-2
M29A-2	0.14295	83	1.15	0.18198	0.0012423	12.7704	0.18413	0.50655	0.0058912	0.8066	2679	14	2663	14	2642	25	2
M29A-3	0.16505	188	0.71	0.18309	0.0011197	12.9981	0.1767	0.51431	0.0056096	0.80234	2683	13	2680	13	2675	24	0
M29A-5-z	0.153	75	0.95	0.18253	0.0012505	12.6985	0.18494	0.50581	0.0057397	0.77914	2672	15	2658	14	2639	25	2
M29A-6	0.14869	33	0.74	0.18606	0.0015776	12.7874	0.20124	0.50174	0.0059671	0.75571	2697	17	2664	15	2621	26	3
M29A-7	0.14165	102	0.7	0.18193	0.0010974	12.645	0.16528	0.50767	0.0052521	0.79151	2659	13	2654	12	2647	22	1
M29A-8	0.15078	75	1.02	0.18255	0.0012014	12.6605	0.17128	0.50684	0.0053299	0.77733	2664	14	2655	13	2643	23	1
M29A-9	0.14511	104	0.55	0.18208	0.0011779	13.0404	0.19996	0.52368	0.006497	0.80907	2658	15	2683	14	2715	27	-3
M29A-11	0.95918	143	0.42	0.18218	0.0012088	12.6283	0.20864	0.50533	0.0070368	0.84285	2664	15	2652	16	2637	30	1
M29A-12	0.151	165	0.77	0.18222	0.0014177	13.0342	0.18833	0.52051	0.0056452	0.75058	2668	16	2682	14	2701	24	-2
M29A-13	0.173	197	0.73	0.1809	0.0010816	13.1563	0.1705	0.5283	0.0053128	0.77597	2659	14	2691	12	2734	22	-3
M29A-15	0.16275	106	0.76	0.18152	0.0012489	13.2623	0.18485	0.52977	0.0055693	0.75425	2667	15	2699	13	2740	23	-3
M29A-16	0.1601	118	1.12	0.18365	0.0011383	13.2845	0.19181	0.52357	0.0058155	0.76927	2689	15	2700	14	2714	25	-1
M29A-17	0.15552	76	1.08	0.18539	0.0012893	13.1781	0.18651	0.51388	0.005317	0.73107	2707	16	2692	13	2673	23	2
M29A-18	0.15915	136	0.95	0.18392	0.0013734	12.875	0.17763	0.50638	0.0050589	0.7241	2693	16	2671	13	2641	22	2
M29A-19	0.16196	121	1.02	0.18124	0.0011061	12.9175	0.1718	0.51585	0.0053617	0.7815	2668	14	2674	13	2682	23	-1
M29A-20	0.29289	42	0.41	0.1842	0.0014295	12.889	0.18727	0.50674	0.0054469	0.7398	2693	16	2672	14	2643	23	2
M29A-21	0.12577	112	0.81	0.18211	0.0011474	12.6905	0.18901	0.50496	0.0058925	0.78348	2674	15	2657	14	2635	25	2
M29A-22	0.148	101	1.12	0.18695	0.0012341	13.3469	0.19257	0.51838	0.0058618	0.78375	2714	15	2705	14	2692	25	1
M29A-23	3.532	275	0.86	0.18366	0.001042	12.8419	0.16949	0.50806	0.0053675	0.80044	2683	13	2668	12	2648	23	2
M29A-24	0.17049	57	0.94	0.18116	0.0011818	12.7914	0.16768	0.51342	0.0051479	0.76488	2659	14	2664	12	2671	22	-1
M29A-25	0.13959	33	0.96	0.18927	0.0016072	13.8448	0.21671	0.53228	0.0063239	0.75901	2730	17	2739	15	2751	27	-1
M29A-26	0.18133	50	1.05	0.1839	0.0013622	13.0032	0.19724	0.5149	0.0060003	0.76827	2682	16	2680	14	2677	26	0
M29A-27	0.148	78	1.57	0.18347	0.0010777	12.7725	0.18737	0.50672	0.0060457	0.81328	2679	14	2663	14	2643	26	2
M29A-28	0.14988	44	0.88	0.1869	0.0013394	13.4881	0.19745	0.52464	0.0059959	0.78069	2711	15	2714	14	2719	25	0
M29A-29	0.17278	146	0.98	0.19244	0.0011974	14.6746	0.21798	0.55371	0.0067423	0.81975	2761	14	2794	14	2841	28	-4
M29A-30	0.17282	73	1.52	0.18102	0.0013676	12.9557	0.19774	0.51905	0.0059974	0.75704	2662	17	2676	14	2695	25	-2
M29A-31	0.15614	148	1.44	0.18136	0.0010682	13.1643	0.19902	0.52581	0.006118	0.76962	2667	16	2691	14	2724	26	-3
M29A-32	0.13624	115	1.06	0.18428	0.0013006	13.1658	0.20015	0.51786	0.0060037	0.76259	2693	16	2692	14	2690	25	0
M29A-33	0.23525	87	1.28	0.18603	0.0013895	13.4805	0.2008	0.52573	0.0059506	0.75986	2707	16	2714	14	2723	25	-1
M29A-34	0.17277	154	1.73	0.18486	0.0011853	13.5304	0.19943	0.53149	0.0063183	0.80654	2695	14	2717	14	2748	27	-2
M29A-35	0.23566	119	0.98	0.19162	0.0010893	14.1493	0.19316	0.53669	0.0057969	0.79121	2753	14	2760	13	2770	24	-1
M29A-36	0.47043	97	1.44	0.18763	0.0016922	12.5276	0.22059	0.48572	0.0065714	0.76836	2716	19	2645	17	2552	28	7
M29A-37	0.22468	233	0.82	0.19152	0.0011023	13.4759	0.19142	0.51139	0.0057244	0.78804	2752	14	2714	13	2663	24	4
M29A-38	0.14251	169	0.25	0.18385	0.00097407	13.5625	0.17099	0.53514	0.0052782	0.78233	2688	13	2720	12	2763	22	-3
M29A-39	0.16958	105	0.85	0.19092	0.0015211	13.4245	0.21237	0.50913	0.0063665	0.79045	2753	16	2710	15	2653	27	4
M29A-40	0.23043	148	1.47	0.18246	0.0010952	12.9998	0.17857	0.51493	0.0056112	0.7933	2681	14	2680	13	2678	24	0
M29A-41	0.15086	134	1.21	0.18239	0.0010572	13.4484	0.20154	0.5319	0.0064458	0.80865	2684	15	2712	14	2749	27	-3
M29A-42	0.1587	125	0.66	0.18366	0.0011451	13.4127	0.18562	0.52837	0.0057274	0.78326	2690	14	2709	13	2735	24	-2
M29A-43	0.1631	158	2	0.18312	0.00095473	13.3482	0.17552	0.52864	0.0057111	0.8216	2681	12	2705	12	2736	24	-2
M29A-44	0.21333	294	1.74	0.18693	0.00096567	13.7482	0.16726	0.53466	0.005183	0.79682	2711	12	2733	12	2761	22	-2
M29A-45	0.15575	90	1.75	0.18321	0.00092917	13.4088	0.16901	0.53331	0.0054136	0.80533	2674	12	2709	12	2755	23	-4

17JAM010 – Ramsay Lake Formation - Joubin Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	RhoXY	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	%Disc
M29A-47	0.18391	128	0.96	0.18316	0.00093796	13.0532	0.16351	0.52072	0.005084	0.7794	2669	13	2684	12	2702	22	-2
M29A-48	0.16547	66	0.95	0.18161	0.00092238	12.7925	0.14987	0.51362	0.0047127	0.7832	2659	12	2664	11	2672	20	-1
M29A-49	0.27029	146	0.48	0.18784	0.00077141	13.3156	0.146	0.51585	0.0045826	0.81018	2718	11	2702	10	2682	19	2
M29A-50	0.71732	24	0.34	0.19024	0.0017442	12.5945	0.18604	0.48077	0.004977	0.70081	2742	17	2650	14	2531	22	9
M29A-51	0.127	225	0.18	0.18108	0.00075536	12.628	0.15326	0.5054	0.0049247	0.8029	2664	12	2652	11	2637	21	1
M29A-52	0.31316	67	0.23	0.18875	0.0011246	12.6691	0.15443	0.48666	0.0044831	0.75569	2732	13	2655	11	2556	19	8
M29A-53	0.41607	108	0.23	0.20722	0.0011195	13.9993	0.1653	0.49045	0.0045602	0.78746	2882	12	2750	11	2573	20	13
M29A-54	0.17155	93	0.24	0.18716	0.00099069	13.4011	0.16716	0.52046	0.0053212	0.81967	2714	12	2708	12	2701	23	1
M29A-55	0.14284	20	0.3	0.19208	0.0016688	13.9138	0.21437	0.52719	0.0061463	0.75669	2754	16	2744	15	2730	26	1
M29A-56	0.12958	54	0.45	0.18188	0.001027	13.531	0.16724	0.54213	0.0050943	0.76026	2662	13	2717	12	2792	21	-6
M29A-57	0.14112	34	0.74	0.18241	0.0011449	13.0429	0.17683	0.52085	0.0055471	0.78557	2668	14	2683	13	2703	24	-2
M29A-58	0.31064	68	0.71	0.18798	0.00083601	13.6656	0.16215	0.52865	0.0052192	0.83205	2720	11	2727	11	2736	22	-1
M29A-59	4.6883	10	0.43	0.19479	0.0019963	14.5408	0.23347	0.54197	0.0062315	0.71611	2781	18	2786	15	2792	26	0
M29A-61	0.20996	95	0.27	0.18536	0.0015013	13.29	0.19966	0.51968	0.006105	0.78195	2702	15	2700	14	2698	26	0
M29A-62	0.11421	33	0.76	0.18895	0.0016624	13.8285	0.22647	0.52959	0.0067532	0.77865	2737	17	2738	15	2740	28	0
M29A-63	0.152	62	0.2	0.18476	0.0014244	13.0795	0.19645	0.51326	0.0061142	0.7931	2697	15	2685	14	2671	26	1
M29A-64	0.16763	52	0.69	0.18747	0.0013385	13.7622	0.18838	0.53279	0.0057127	0.78332	2719	14	2733	13	2753	24	-2
M29A-66	0.17076	36	0.82	0.18458	0.0014677	13.2742	0.19661	0.52249	0.006051	0.7819	2692	15	2699	14	2710	26	-1
M29A-67	0.155	63	0.64	0.18529	0.001325	13.2593	0.19402	0.52046	0.0060903	0.79969	2696	14	2698	14	2701	26	0
M29A-69	0.22911	134	0.93	0.18996	0.0016183	14.3954	0.22873	0.55174	0.006676	0.76153	2735	17	2776	15	2832	28	-4
M29A-70	0.18965	58	0.71	0.18911	0.0018418	14.1052	0.22892	0.54299	0.0063471	0.72022	2728	18	2757	15	2796	26	-3
M29A-71	0.18718	145	0.51	0.18871	0.0015729	13.9191	0.20924	0.53638	0.0061739	0.76569	2727	16	2744	14	2768	26	-2
M29A-72	0.17224	154	0.4	0.18935	0.0013723	14.3665	0.19432	0.55111	0.0057754	0.77477	2734	14	2774	13	2830	24	-4
M29A-73	0.15967	62	0.7	0.18736	0.0016537	14.3588	0.23142	0.55604	0.0070364	0.78518	2719	16	2774	15	2850	29	-6
M29A-74	0.14326	63	0.3	0.18478	0.0016208	13.8148	0.22784	0.54185	0.0070166	0.78517	2697	17	2737	16	2791	29	-4
M29A-75	0.13621	129	0.75	0.18462	0.0013245	13.0415	0.18477	0.51244	0.00578	0.79614	2694	14	2683	13	2667	25	1
M29A-76	0.14812	111	0.68	0.18355	0.0013414	13.4118	0.17973	0.53059	0.0055017	0.77376	2683	14	2709	13	2744	23	-3
M29A-77	0.92343	90	0.76	0.18165	0.001303	13.1735	0.18147	0.52714	0.0057771	0.79556	2664	14	2692	13	2729	24	-3
M29A-78	0.16337	119	0.8	0.18364	0.0013676	13.1648	0.182	0.52162	0.0055939	0.7757	2681	14	2692	13	2706	24	-1
M29A-79	0.44197	141	0.34	0.19183	0.0011622	14.5612	0.21073	0.55286	0.0066966	0.83697	2751	13	2787	14	2837	28	-4
M29A-80	0.16973	50	0.35	0.18911	0.0014168	13.8215	0.20006	0.53252	0.0060441	0.78416	2727	15	2738	14	2752	25	-1
M29A-81	0.17525	128	0.6	0.18103	0.001142	12.8875	0.16965	0.51837	0.0055681	0.81601	2656	13	2671	12	2692	24	-2
M29A-82	0.12657	14	0.33	0.18634	0.0022696	13.0382	0.25569	0.50913	0.0075746	0.75865	2705	21	2682	18	2653	32	2
M29A-83	0.16242	53	0.3	0.18674	0.0014254	13.3379	0.17988	0.51939	0.005414	0.77291	2709	14	2704	13	2697	23	1
M29A-84	0.18525	59	0.66	0.18423	0.001283	13.1118	0.1803	0.51719	0.0057186	0.8041	2688	13	2688	13	2687	24	0
M29A-85	0.16682	52	0.48	0.1836	0.0012653	13.2465	0.18896	0.52354	0.0062185	0.83267	2685	13	2697	13	2714	26	-1
M29A-86	0.1355	41	0.17	0.18743	0.0013969	14.0289	0.18359	0.54289	0.0055038	0.7747	2720	14	2752	12	2796	23	-3
M29A-87	0.13521	50	0.5	0.18235	0.0012343	12.9025	0.16101	0.51301	0.0050499	0.78883	2675	13	2673	12	2669	22	0
M29A-88	0.78067	43	0.19	0.18659	0.001253	12.6282	0.1675	0.49049	0.0052757	0.81093	2714	13	2652	12	2573	23	6
M29A-89	0.31	88	0.62	0.18254	0.0013733	12.7347	0.17789	0.50538	0.0055176	0.78157	2678	14	2660	13	2637	24	2
M29A-90	0.175	92	0.83	0.18075	0.0011516	13.4031	0.19402	0.53901	0.0066	0.84586	2656	13	2708	14	2779	28	-6
M29A-91	0.12304	28	0.5	0.19016	0.0013948	13.553	0.18582	0.52004	0.0056384	0.79082	2734	14	2719	13	2699	24	2

17JAM010 – Ramsay Lake Formation - Joubin Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
M29A-92	0.19306	77	0.33	0.1854	0.0012521	13.0394	0.17374	0.5151	0.0054916	0.80015	2686	13	2683	13	2678	23	0
M29A-93	0.14639	68	0.69	0.18406	0.0013723	12.8941	0.17313	0.51499	0.0051717	0.74792	2667	15	2672	13	2678	22	0
M29A-94	0.14808	157	1.04	0.18216	0.0011836	12.2105	0.17549	0.49462	0.005662	0.79649	2644	14	2621	13	2591	24	2
M29A-95	1.0349	184	0.48	0.28217	0.0034525	16.1395	0.29701	0.42144	0.0053507	0.68992	3350	21	2885	18	2267	24	38
M29A-96	0.70505	164	0.54	0.1871	0.001027	11.7808	0.15526	0.46271	0.0050628	0.83025	2695	12	2587	12	2452	22	11
M29A-97-c	0.151	104	0.54	0.19027	0.0011221	13.3374	0.17446	0.51378	0.0054543	0.81159	2727	13	2704	12	2673	23	2
M29A-97-r	0.17051	91	0.44	0.18795	0.0011278	13.5374	0.19247	0.52652	0.0062067	0.82911	2711	13	2718	13	2727	26	-1
M29A-98	0.16331	42	0.55	0.18867	0.0015006	13.6124	0.2145	0.52603	0.0064524	0.77845	2722	16	2723	15	2725	27	0
M29A-99	0.12758	43	0.77	0.18176	0.0012936	12.9062	0.20074	0.51518	0.0064736	0.80787	2668	15	2673	15	2679	28	0
M29A-100	0.16042	153	0.35	0.19225	0.00092521	13.5746	0.16877	0.51115	0.0052498	0.82609	2765	11	2720	12	2662	22	5
M29A-101	0.13717	74	0.35	0.18693	0.0010956	13.8299	0.18092	0.53437	0.0056855	0.81334	2722	13	2738	12	2760	24	-2
M29A-102	0.16958	43	0.59	0.1879	0.0013594	13.9265	0.18883	0.5341	0.0054762	0.75617	2734	15	2745	13	2759	23	-1
M29A-103	0.16	52	0.76	0.18281	0.0011434	13.3718	0.18673	0.52591	0.0057959	0.78918	2693	14	2706	13	2724	24	-1
M29A-104-k	4.6967	373	0.58	0.18843	0.0007796	12.3346	0.15262	0.47112	0.0048544	0.83278	2741	11	2630	12	2488	21	11
M29A-105	0.17931	62	0.59	0.18309	0.0012313	13.3674	0.17453	0.52629	0.0051951	0.75605	2691	14	2706	12	2726	22	-2
M29A-106	0.136	93	0.63	0.18157	0.0012048	12.8828	0.17862	0.5123	0.0055603	0.78282	2675	14	2671	13	2666	24	0
M29A-107	0.16023	529	0.15	0.18142	0.00080654	13.1738	0.16856	0.52513	0.005417	0.80621	2671	13	2692	12	2721	23	-2
M29A-108	0.15558	62	0.6	0.18133	0.0013071	13.831	0.24033	0.5525	0.0078289	0.8155	2667	17	2738	16	2836	32	-8
M29A-109	0.15238	98	0.99	0.18141	0.0011968	13.2994	0.20386	0.53181	0.0063732	0.78183	2665	16	2701	14	2749	27	-4
M29A-110	0.18036	291	1.57	0.18121	0.00087149	13.6757	0.18337	0.54737	0.0059479	0.81043	2664	13	2728	13	2814	25	-7
M29A-111	0.16691	329	1	0.1816	0.00073457	13.2948	0.16568	0.5309	0.0053463	0.80805	2668	12	2701	12	2745	23	-4
M29A-112	0.2069	353	0.68	0.18984	0.00086742	14.4106	0.18964	0.55038	0.0057089	0.78823	2741	13	2777	12	2827	24	-4
M29A-113	0.16681	105	1.15	0.18641	0.0011445	13.7968	0.20426	0.53656	0.0059124	0.7443	2711	16	2736	14	2769	25	-3

17JAM011 – Mississagi Formation - Gunterman Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
6.1	0.17929	138	1.07	0.18368	0.000541	13.2726	0.10449	0.52309	0.0035358	0.85857	2689	7	2699	7	2712	15	-1
6.2	0.19456	174	1.26	0.18559	0.00046653	13.4027	0.091529	0.52293	0.0030283	0.84798	2706	6	2708	6	2712	13	0
6.3	0.1687	137	1.11	0.1843	0.00054823	13.1666	0.092086	0.51743	0.0029548	0.8165	2694	7	2692	7	2688	13	0
6.4	0.21047	159	1.23	0.18562	0.00043372	13.4102	0.097668	0.52337	0.0032246	0.84596	2706	6	2709	7	2713	14	0
7	0.27674	40	0.47	0.19755	0.00086655	15.3305	0.14294	0.56313	0.0043109	0.82105	2805	9	2836	9	2880	18	-3
8	0.27772	163	1.08	0.18256	0.0004949	13.1083	0.085916	0.52181	0.0027833	0.81381	2673	6	2687	6	2707	12	-2
9	0.27258	112	1.2	0.18511	0.00057158	13.371	0.10395	0.52569	0.0034648	0.84774	2693	7	2706	7	2723	15	-1
10	0.32245	309	0.52	0.15949	0.00040414	10.1444	0.085534	0.46358	0.0034275	0.87688	2442	7	2448	8	2455	15	-1
11	0.37151	205	0.66	0.18697	0.00049425	13.5416	0.12772	0.52671	0.0045032	0.90648	2711	7	2718	9	2728	19	-1
12	0.49672	245	0.42	0.15973	0.00037925	10.2602	0.08322	0.46627	0.0033748	0.89236	2451	6	2459	7	2467	15	-1
13	0.62006	328	0.68	0.22263	0.00048394	18.3436	0.13647	0.59699	0.0039023	0.87864	3001	6	3008	7	3018	16	-1
14	8.2813	253	0.47	0.20686	0.00077809	10.3051	0.15255	0.36028	0.0050403	0.94505	2886	8	2463	14	1984	24	36
15.1	0.5839	368	0.43	0.1598	0.00035162	10.2482	0.084235	0.46295	0.0032996	0.86714	2461	7	2457	8	2453	15	0
15.2	1.1215	343	0.44	0.16034	0.00037942	10.4615	0.081825	0.47075	0.0031557	0.85708	2468	7	2477	7	2487	14	-1
15.3	0.53932	346	0.45	0.15982	0.00031968	10.3407	0.069907	0.46747	0.0027246	0.86213	2460	6	2466	6	2472	12	-1
15.4	0.49217	351	0.41	0.15899	0.00039274	10.4153	0.086097	0.47396	0.0035191	0.8982	2449	6	2472	8	2501	15	-3
15.5	0.5219	362	0.48	0.1591	0.00035784	10.3588	0.07375	0.47171	0.0028653	0.85316	2448	6	2467	7	2491	13	-2
15.6	0.58201	350	0.4	0.16031	0.00035074	10.1658	0.064433	0.46078	0.0024395	0.83531	2456	6	2450	6	2443	11	1
15.7	0.49377	377	0.45	0.1596	0.0004004	10.2304	0.075122	0.46613	0.0029679	0.86708	2447	6	2456	7	2467	13	-1
15.8	1.6232	418	0.27	0.16048	0.000371	10.7515	0.11114	0.48756	0.0047053	0.93358	2455	6	2502	10	2560	20	-5
15.9	6.9586	410	0.4	0.15734	0.0003882	9.6236	0.10379	0.44546	0.0044324	0.92259	2420	7	2399	10	2375	20	2
16	0.29644	176	0.88	0.1848	0.00049379	13.0976	0.11485	0.51538	0.0040079	0.88681	2692	7	2687	8	2680	17	1
17	0.34683	149	0.3	0.22843	0.00057689	18.6032	0.15173	0.59151	0.0042716	0.88543	3039	6	3021	8	2996	17	2
18	0.25874	382	0.6	0.18147	0.00038548	12.7649	0.097798	0.51033	0.0034697	0.88741	2666	6	2662	7	2658	15	0
19	0.52857	155	0.53	0.2702	0.00060502	23.4459	0.1888	0.62878	0.004474	0.88361	3309	6	3246	8	3145	18	6
20	17.9326	731	0.3	0.20583	0.00039204	20.8062	0.26909	0.73166	0.0090181	0.95301	2876	6	3130	12	3540	34	-30
21	0.20472	60	0.14	0.18321	0.0007874	13.1947	0.11386	0.52162	0.0034864	0.77457	2684	9	2694	8	2706	15	-1
22	0.39792	284	0.3	0.15971	0.00038321	10.041	0.081035	0.45617	0.0032348	0.87866	2452	7	2439	7	2423	14	1
23	0.37781	230	0.34	0.18624	0.00056468	13.1559	0.10339	0.51349	0.0033962	0.84159	2706	7	2691	7	2671	14	2
24	0.26883	115	0.46	0.1875	0.00065453	13.5553	0.11831	0.52649	0.0038504	0.83795	2714	8	2719	8	2727	16	-1
25	0.497	279	0.21	0.1849	0.00043534	12.894	0.095517	0.50878	0.0030203	0.80137	2688	7	2672	7	2651	13	2
26	0.98945	153	0.48	0.23604	0.00068426	19.2954	0.24672	0.59612	0.0071775	0.94165	3085	7	3057	12	3014	29	3
27	0.28665	241	0.6	0.18632	0.00044197	13.3646	0.093497	0.52246	0.003105	0.84951	2703	6	2706	7	2710	13	0
28.1	0.22978	88	0.48	0.18127	0.00067059	12.751	0.10731	0.51177	0.0036008	0.83608	2659	8	2661	8	2664	15	0
28.2	0.20334	59	0.67	0.1818	0.00073681	12.8414	0.10809	0.5133	0.0034581	0.8004	2666	8	2668	8	2671	15	0
28.3	0.23102	61	0.66	0.18327	0.00066057	12.9518	0.099347	0.51318	0.0031213	0.79295	2681	8	2676	7	2670	13	0
28.4	0.22791	67	0.63	0.18054	0.00054377	12.7609	0.090026	0.51348	0.0029864	0.82442	2655	7	2662	7	2671	13	-1
28.5	0.25023	64	0.56	0.1835	0.00067758	13.0106	0.095902	0.51529	0.003023	0.79588	2681	7	2680	7	2679	13	0
28.6	0.29926	130	0.54	0.18288	0.00044682	13.1471	0.087364	0.52268	0.0029153	0.83934	2675	6	2690	6	2711	12	-2
28.7	0.24913	79	0.52	0.18263	0.00064352	13.0142	0.098985	0.5183	0.0031175	0.79081	2672	8	2681	7	2692	13	-1
28.8	0.2486	70	0.58	0.18254	0.00061989	13.0769	0.094896	0.51934	0.0030272	0.80324	2677	7	2685	7	2696	13	-1
28.9	0.2325	68	0.62	0.18306	0.00060297	13.2293	0.09368	0.52293	0.0029987	0.80981	2685	7	2696	7	2712	13	-1

17JAM011 – Mississagi Formation - Gunterman Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
28.1	0.28978	141	0.67	0.18199	0.00050323	13.1526	0.085706	0.52198	0.0027488	0.80815	2678	6	2691	6	2708	12	-1
28.11	0.28642	147	0.72	0.18157	0.00046079	12.9365	0.088089	0.51363	0.0028478	0.81424	2677	7	2675	6	2672	12	0
28.12	0.24564	135	0.84	0.18186	0.00047903	13.0206	0.089077	0.51682	0.0029143	0.82425	2678	6	2681	6	2686	12	0
29	0.82902	43	0.66	0.18137	0.00073624	13.0813	0.11651	0.52229	0.0039078	0.84004	2668	8	2686	8	2709	17	-2
30	0.25465	85	0.98	0.18409	0.0006016	12.9892	0.10936	0.51257	0.003665	0.84928	2687	7	2679	8	2668	16	1
31	1.8385	132	1.29	0.18108	0.00053859	11.268	0.098893	0.45306	0.0034345	0.86376	2656	7	2546	8	2409	15	11
32	0.46328	100	0.85	0.19894	0.00062458	14.6255	0.1305	0.53478	0.0041806	0.87614	2813	7	2791	8	2762	18	2
33	0.33361	224	0.39	0.15891	0.00043621	10.0465	0.079765	0.45946	0.0031523	0.86415	2441	7	2439	7	2437	14	0
34	8.0017	88	1.01	0.17418	0.00068651	11.8893	0.11724	0.4956	0.0041945	0.85828	2596	8	2596	9	2595	18	0
35	0.31394	51	0.31	0.27298	0.00092508	24.8954	0.21427	0.66155	0.004631	0.81335	3323	8	3304	8	3273	18	2
36	0.41303	113	0.33	0.18704	0.00062377	13.6482	0.10915	0.52866	0.0034427	0.81426	2718	8	2726	8	2736	15	-1
37	0.32012	44	0.58	0.18483	0.00073155	13.2326	0.10917	0.51862	0.0034617	0.80908	2699	8	2696	8	2693	15	0
38	3.4076	70	0.86	0.1839	0.00061743	12.7492	0.10086	0.5021	0.0033659	0.84737	2691	7	2661	7	2623	14	3
39	0.36159	141	1.97	0.18865	0.00050668	13.7761	0.10635	0.52882	0.0035999	0.88181	2733	6	2734	7	2736	15	0
42	0.38068	143	0.85	0.18254	0.00049654	12.9059	0.10254	0.5119	0.0035794	0.88004	2679	6	2673	7	2665	15	1
43	0.25017	109	0.72	0.18416	0.00052239	12.8532	0.095787	0.50508	0.0032614	0.86646	2694	6	2669	7	2636	14	3
44	2.3948	190	0.48	0.2293	0.00049436	13.8424	0.1112	0.43671	0.0032173	0.91712	3051	5	2739	8	2336	14	28
47	0.3829	100	0.71	0.18761	0.00050278	13.7982	0.12189	0.53187	0.0042102	0.89606	2726	6	2736	8	2749	18	-1

17JAM011 – Mississagi Formation - Gunterman Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
50	0.28416	132	0.43	0.21642	0.00060139	17.8567	0.13455	0.59521	0.003884	0.86599	2963	6	2982	7	3011	16	-2
51	0.2852	85	0.36	0.18449	0.00056148	13.4579	0.10756	0.52584	0.0036627	0.87155	2704	6	2712	8	2724	15	-1
52	0.43534	359	1.05	0.18465	0.00036272	14.5973	0.14797	0.56948	0.0054679	0.94718	2706	5	2789	10	2906	22	-9
53	0.387	24	0.46	0.22434	0.0011243	18.5852	0.17958	0.59636	0.0046161	0.80108	3024	9	3021	9	3015	19	0
54	0.24328	72	0.27	0.18086	0.00062888	13.0138	0.11244	0.51789	0.0038457	0.85945	2673	7	2681	8	2690	16	-1
56	0.35388	35	0.67	0.19876	0.00083319	15.2306	0.12744	0.55187	0.0037791	0.81841	2828	8	2830	8	2833	16	0
57	0.27121	52	1.53	0.18237	0.00069807	13.0362	0.094197	0.51509	0.0029241	0.78564	2685	7	2682	7	2678	12	0
58	0.2825	61	0.37	0.18407	0.00068228	13.1397	0.10866	0.51469	0.0035606	0.83656	2700	7	2690	8	2677	15	1
59	0.47421	276	0.33	0.19744	0.00045385	14.9271	0.12481	0.5454	0.0041853	0.91777	2814	5	2811	8	2806	17	0
60	0.24341	41	1.28	0.18175	0.00078379	12.8614	0.10592	0.51045	0.0033763	0.80314	2678	8	2670	8	2659	14	1
61	0.29002	68	0.42	0.19803	0.00067952	14.7103	0.16658	0.53584	0.0056207	0.92632	2819	7	2797	11	2766	24	2
63	2.6946	199	0.34	0.1878	0.00050387	9.9875	0.082279	0.3836	0.0027685	0.87606	2732	7	2434	8	2093	13	27
65	0.27526	204	0.31	0.15797	0.00039506	10.0512	0.081875	0.45946	0.0033494	0.89493	2441	6	2439	8	2437	15	0
69	0.31292	79	0.7	0.19922	0.0006827	15.1604	0.11971	0.55016	0.0035961	0.82777	2825	7	2825	8	2826	15	0
70	0.46	471	0.31	0.158	0.00034132	10.4815	0.067053	0.47937	0.0025652	0.83649	2441	6	2478	6	2525	11	-4
71	0.23938	78	0.32	0.18583	0.00058302	13.5385	0.091245	0.52601	0.0028567	0.80582	2713	7	2718	6	2725	12	-1
72	0.21727	208	0.74	0.18008	0.00041809	12.8438	0.074355	0.5145	0.0024264	0.81462	2663	6	2668	5	2676	10	-1
74	0.37867	287	0.22	0.30372	0.00056959	30.7766	0.18572	0.73037	0.0037145	0.84278	3499	5	3512	6	3535	14	-1
76	2.25	30	0.43	0.1844	0.00088734	13.5426	0.12148	0.52831	0.0037842	0.79854	2706	9	2718	8	2734	16	-1
77	0.38468	72	0.4	0.18639	0.00060044	13.7743	0.10467	0.53101	0.0034625	0.85807	2726	6	2734	7	2746	15	-1
79	0.30924	112	0.4	0.18111	0.00057239	13.9782	0.10042	0.55394	0.0033008	0.82944	2680	7	2748	7	2842	14	-7
80	0.30055	120	0.11	0.182	0.00042919	12.9952	0.091472	0.51228	0.0031867	0.88376	2689	5	2679	7	2666	14	1
82	0.22791	262	0.52	0.17912	0.00040181	12.8067	0.089745	0.51317	0.0032268	0.89729	2662	5	2666	7	2670	14	0
83	1.1438	84	0.33	0.2318	0.0012661	19.5661	0.17821	0.60605	0.0042133	0.76331	3081	9	3070	9	3054	17	1
85	0.33116	46	0.4	0.18623	0.0007373	13.8756	0.11415	0.53552	0.0036497	0.8284	2724	8	2741	8	2765	15	-2
87	3.0497	257	0.59	0.15798	0.00038418	9.5186	0.094317	0.43357	0.0040312	0.93833	2447	6	2389	9	2322	18	6
88	0.45239	51	0.44	0.1872	0.00071824	13.8112	0.11563	0.53154	0.0036654	0.82367	2729	8	2737	8	2748	15	-1
90	0.28692	145	0.33	0.19894	0.00049836	15.3008	0.10846	0.55254	0.0033807	0.86316	2833	6	2834	7	2836	14	0
91	0.22766	180	1.04	0.1837	0.00046201	13.2812	0.08407	0.51836	0.0027308	0.83224	2706	6	2700	6	2692	12	1
92	0.22735	18	0.38	0.18273	0.0012225	13.1538	0.13858	0.51509	0.0039719	0.73193	2700	12	2691	10	2678	17	1
93	0.32529	291	0.44	0.1571	0.00032635	10.1446	0.076147	0.46112	0.0030287	0.87503	2451	6	2448	7	2444	13	0
96	0.22028	70	0.94	0.18123	0.00061916	13.2136	0.10084	0.52013	0.0032463	0.81786	2692	7	2695	7	2700	14	0
98	0.49857	117	0.29	0.19624	0.00059006	13.8628	0.098676	0.50443	0.0030227	0.84185	2821	6	2740	7	2633	13	8
99	0.32265	74	0.53	0.18058	0.0005808	13.0803	0.10253	0.51778	0.003451	0.85034	2682	7	2685	7	2690	15	0
100	1.0118	102	0.97	0.17922	0.000532	10.689	0.19008	0.42696	0.0074129	0.97633	2667	6	2496	16	2292	33	17
101	0.22514	29	0.28	0.18737	0.00090442	13.7119	0.11352	0.52401	0.003299	0.76043	2740	9	2730	8	2716	14	1
103	0.26155	139	0.63	0.17904	0.00045448	12.9502	0.091311	0.51803	0.0031425	0.86034	2665	6	2676	7	2691	13	-1
104	0.25023	128	0.6	0.18309	0.00051975	13.2945	0.092192	0.52018	0.0029174	0.80877	2701	7	2701	7	2700	12	0
105	0.39258	58	0.28	0.18405	0.00062392	12.3165	0.10711	0.4796	0.0035706	0.85605	2709	7	2629	8	2526	16	8
106	0.36689	102	0.63	0.18227	0.00053916	13.3401	0.095754	0.52462	0.0031353	0.83259	2693	7	2704	7	2719	13	-1
107	0.20361	77	0.49	0.18502	0.0006021	13.512	0.10358	0.52358	0.0033625	0.8378	2717	7	2716	7	2714	14	0
108	0.17849	74	0.79	0.18291	0.00066118	13.3812	0.10496	0.52457	0.0033235	0.8077	2698	8	2707	7	2719	14	-1

17JAM011 – Mississagi Formation - Gunterman Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
109	0.30026	190	0.34	0.15741	0.00041337	10.1361	0.082907	0.46181	0.0032248	0.85374	2447	7	2447	8	2448	14	0
110	0.37947	376	0.36	0.1569	0.00038626	10.103	0.074164	0.46132	0.0028599	0.84451	2443	7	2444	7	2445	13	0
111	0.2857	68	0.48	0.18934	0.00070016	14.2107	0.12564	0.53737	0.0040317	0.84858	2758	8	2764	8	2772	17	-1
112	0.3677	95	0.96	0.19726	0.00065955	14.9113	0.12219	0.54088	0.0037332	0.84231	2826	7	2810	8	2787	16	2
113	0.2562	71	0.5	0.18498	0.00075436	13.7476	0.11011	0.53144	0.0032655	0.76718	2721	8	2732	8	2748	14	-1
114	0.32049	88	0.39	0.18511	0.00068714	13.3546	0.12505	0.51557	0.0040395	0.83671	2724	8	2705	9	2680	17	2
115	2.377	401	0.61	0.19776	0.00045465	13.6351	0.13666	0.49274	0.004495	0.91019	2832	7	2725	9	2583	19	11
116	0.58856	370	0.53	0.17015	0.00039599	11.3842	0.085064	0.47848	0.0030771	0.86067	2583	6	2555	7	2521	13	3
117	0.31118	100	0.54	0.15781	0.00056063	9.4993	0.074047	0.43075	0.0027318	0.81359	2455	8	2387	7	2309	12	7
119	0.26559	163	1.15	0.18105	0.00051498	12.7813	0.095684	0.50553	0.0031741	0.83869	2684	7	2664	7	2638	14	2
120	0.7832	231	1.14	0.26512	0.00052355	22.7251	0.25044	0.61421	0.0063436	0.93717	3296	6	3215	11	3087	25	8
121	0.32515	63	0.61	0.18596	0.00066562	13.6008	0.11581	0.52377	0.0037484	0.84051	2728	8	2722	8	2715	16	1
122	2.6128	53	0.77	0.16682	0.00072956	11.3948	0.091159	0.48885	0.0030198	0.77217	2548	9	2556	7	2566	13	-1
123	0.88186	97	0.9	0.18302	0.00056802	11.7542	0.095505	0.45933	0.0032617	0.87395	2704	7	2585	8	2437	14	12
125	0.2959	86	0.59	0.25234	0.00059294	23.1055	0.14649	0.65445	0.0034913	0.84141	3223	5	3231	6	3246	14	-1
126	0.21215	119	1.07	0.1811	0.00048347	13.2551	0.10541	0.52279	0.0036457	0.8769	2688	6	2698	8	2711	15	-1
127	0.22993	51	0.68	0.20266	0.00077935	15.8419	0.13768	0.55815	0.0040882	0.84279	2873	8	2867	8	2859	17	1
128	0.51307	78	1.14	0.21978	0.00068352	18.3617	0.14198	0.59668	0.0039829	0.86327	3004	6	3009	7	3016	16	-1
129	0.22622	75	1.42	0.18217	0.00053833	13.4102	0.095001	0.52589	0.0031676	0.85026	2698	6	2709	7	2724	13	-1
130	0.2615	96	0.51	0.18327	0.00048432	13.1656	0.08774	0.51335	0.0028813	0.84221	2707	6	2692	6	2671	12	2
131	0.21821	97	1.77	0.17961	0.00049958	12.8531	0.095155	0.51151	0.0032047	0.84627	2673	7	2669	7	2663	14	0
132	0.30888	199	1.74	0.17826	0.00048461	12.8168	0.097574	0.51478	0.0034129	0.87085	2658	6	2666	7	2677	15	-1
133	1.7916	114	0.78	0.19126	0.0006076	10.5791	0.078742	0.39631	0.0024858	0.8427	2773	7	2487	7	2152	11	26
134	7.2005	117	0.44	0.1825	0.00091716	4.891	0.06695	0.19215	0.0023986	0.91193	2695	9	1801	11	1133	13	63
135	0.2214	339	1.89	0.18063	0.00036148	13.0804	0.099262	0.51957	0.0035234	0.89363	2677	6	2685	7	2697	15	-1
136	0.26319	194	0.38	0.18563	0.00042884	13.7271	0.12158	0.53095	0.0042224	0.89791	2720	6	2731	8	2745	18	-1
137	0.22833	91	0.69	0.19254	0.0006313	14.6905	0.13106	0.54772	0.0042183	0.86324	2781	7	2795	8	2816	18	-2
140	0.25847	267	0.4	0.18644	0.0004574	13.9344	0.11618	0.53609	0.0040111	0.89739	2729	6	2745	8	2767	17	-2
141	0.22441	136	0.81	0.24018	0.00068945	21.0798	0.15749	0.629	0.0040045	0.85214	3140	6	3142	7	3146	16	0
142	0.32643	119	0.66	0.18649	0.00053026	13.5888	0.11087	0.52178	0.0037026	0.86971	2732	7	2721	8	2707	16	1
143	0.35586	190	0.68	0.18503	0.00049994	13.3558	0.11962	0.51644	0.0040709	0.88012	2721	7	2705	8	2684	17	2
144	0.3746	155	1.26	0.22212	0.00061325	18.2799	0.13919	0.59	0.0038057	0.8471	3015	6	3005	7	2989	15	1
145	4.6867	269	0.52	0.21786	0.00054125	14.2064	0.10973	0.46816	0.0031781	0.87893	2981	6	2764	7	2475	14	20
146	0.25606	274	0.34	0.263	0.00053165	24.6528	0.19068	0.6739	0.0046946	0.90067	3279	5	3295	8	3321	18	-2
147	0.25432	94	0.59	0.19689	0.00069377	14.8	0.1335	0.54118	0.004219	0.86426	2813	7	2802	9	2788	18	1
148	0.98658	84	0.76	0.18072	0.00076008	11.279	0.13661	0.44996	0.0049028	0.8996	2669	9	2546	11	2395	22	12
149	3.3871	470	0.77	0.18597	0.00046361	14.7457	0.14676	0.57176	0.0052074	0.91511	2716	7	2799	9	2915	21	-9
150	0.78667	98	0.55	0.1574	0.00065898	10.225	0.082778	0.46788	0.0029641	0.78255	2440	9	2455	7	2474	13	-2
151	0.42441	202	0.45	0.18705	0.00066155	14.3264	0.10551	0.55097	0.0032229	0.7943	2730	7	2772	7	2829	13	-4
152	0.2465	291	0.42	0.18019	0.00046124	12.8228	0.08319	0.51129	0.0026438	0.79703	2670	6	2667	6	2662	11	0
154	1.0666	352	0.27	0.19886	0.00060183	14.0621	0.10602	0.50743	0.0030414	0.79497	2834	7	2754	7	2646	13	8
155	4.6814	219	0.61	0.19637	0.00054789	12.3536	0.21677	0.45102	0.0077172	0.9751	2815	6	2632	16	2400	34	18

17JAM011 – Mississagi Formation - Gunterman Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig 1	206Pb/ 238U	Sig1	%Disc
156	0.196	42	0.99	0.18385	0.00069242	12.9771	0.093475	0.50614	0.0028556	0.78326	2707	7	2678	7	2640	12	3
157	0.3088	95	0.8	0.18078	0.00057237	12.8953	0.095742	0.51157	0.0031824	0.83789	2679	7	2672	7	2663	14	1
158	0.86996	76	0.64	0.18099	0.00064722	10.2449	0.08726	0.40495	0.0029706	0.86126	2685	7	2457	8	2192	14	22
159	0.21644	27	1.47	0.27019	0.0011612	25.2917	0.20735	0.66791	0.004378	0.79953	3333	8	3320	8	3298	17	1
160	1.0635	95	0.68	0.183	0.00058535	11.3604	0.077945	0.4418	0.0023526	0.77611	2712	7	2553	6	2359	11	16

16CG106 (Menard, 2017) - Matinenda Formation - Drury Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
CG106-001	0.17139	87	1.49	0.1833	0.0011489	12.6772	0.16911	0.51259	0.0049955	0.73057	2647	15	2656	13	2668	21	-1
CG106-004	0.53698	417	1.51	0.17854	0.00072567	12.1313	0.14318	0.49594	0.004632	0.79131	2629	12	2615	11	2596	20	1
CG106-005	0.17833	80	1.31	0.18315	0.0011185	12.5128	0.15337	0.49813	0.0045875	0.75139	2673	13	2644	12	2606	20	3
CG106-006	0.30194	306	1.1	0.18113	0.00070015	13.1472	0.1522	0.52863	0.0048611	0.79432	2656	12	2690	11	2736	21	-4
106-001	1.5069	519	0.76	0.1788	0.00050735	11.5001	0.09711	0.4705	0.0029284	0.73706	2628	10	2565	8	2486	13	6
106-002	3.0658	640	0.7	0.18377	0.0005342	12.4779	0.11965	0.49681	0.0040264	0.8452	2673	8	2641	9	2600	17	3
106-003	1.4096	198	0.95	0.18534	0.00056386	13.2127	0.12595	0.52172	0.0042165	0.8478	2686	8	2695	9	2706	18	-1
106-006	0.24293	51	0.75	0.18038	0.00102	12.2374	0.13134	0.49662	0.003949	0.7409	2641	12	2623	10	2599	17	2
106-008	0.76445	309	0.68	0.17956	0.00057075	11.7841	0.12195	0.48108	0.0042396	0.85155	2631	9	2587	10	2532	18	5
106-012	0.50664	369	1.42	0.17999	0.00048396	12.3034	0.10187	0.50168	0.0034561	0.83206	2633	8	2628	8	2621	15	1
106-013	0.52757	374	0.76	0.18086	0.00050822	12.3538	0.10862	0.50192	0.0037892	0.85866	2639	7	2632	8	2622	16	1
106-014	2.1944	268	0.56	0.25444	0.0014323	16.0898	0.16247	0.46522	0.0034603	0.73657	3190	11	2882	10	2463	15	27
106-015	0.63636	740	0.07	0.17837	0.00039791	12.4089	0.11897	0.51165	0.0043475	0.8863	2615	7	2636	9	2664	19	-2
106-019	0.50659	92	1.03	0.21583	0.00085329	14.1302	0.1337	0.48135	0.003834	0.84179	2928	8	2758	9	2533	17	16
106-020	0.67258	273	0.58	0.17575	0.00054746	11.9933	0.10944	0.50128	0.0040129	0.87727	2592	7	2604	9	2619	17	-1
106-021	0.37395	107	0.3	0.1811	0.00060971	12.4772	0.11684	0.50565	0.0040702	0.85962	2643	8	2641	9	2638	17	0
106-022c	0.8175	202	0.4	0.18081	0.00047631	12.6202	0.11069	0.51188	0.0039063	0.87005	2642	7	2652	8	2665	17	-1
106-022r	0.32449	295	0.45	0.18185	0.0004393	12.6095	0.10347	0.50957	0.0036885	0.88213	2648	6	2651	8	2655	16	0
106-025	0.33441	155	0.55	0.18147	0.00050221	12.6245	0.10707	0.51139	0.0038011	0.87643	2644	7	2652	8	2663	16	-1
106-029	6.8124	327	0.41	0.18451	0.00057482	11.9256	0.11477	0.47549	0.0040065	0.87555	2670	8	2599	9	2508	17	7
106-030	3.9783	325	1.52	0.18013	0.00039699	11.932	0.092602	0.4872	0.0031927	0.84439	2631	7	2599	7	2559	14	3
106-032	0.5977	70	0.42	0.19475	0.00094769	13.6928	0.12481	0.51718	0.0036342	0.77094	2760	10	2729	9	2687	15	3
106-033	1.1501	159	1.54	0.17626	0.00059726	11.9953	0.10057	0.50034	0.0034559	0.82384	2595	8	2604	8	2615	15	-1
106-034	1.4594	139	1.06	0.17776	0.000595	11.524	0.10579	0.47639	0.0036174	0.82715	2610	9	2567	9	2512	16	5
106-038	0.51161	128	1.11	0.18126	0.00069012	12.46	0.10844	0.50428	0.0034083	0.7766	2645	9	2640	8	2632	15	1
106-040	1.9227	232	0.46	0.17601	0.00057134	11.8983	0.096823	0.49531	0.003289	0.816	2599	8	2596	8	2594	14	0
106-041	0.77238	142	1.4	0.17963	0.00067538	12.298	0.12028	0.50102	0.0042061	0.85832	2635	8	2627	9	2618	18	1
106-044	0.2072	145	1.46	0.18023	0.00066745	12.8016	0.13019	0.51919	0.0045184	0.85573	2642	9	2665	10	2696	19	-2
106-045	0.38903	933	0.26	0.17929	0.00040229	12.903	0.11512	0.52569	0.0040949	0.87311	2634	7	2673	8	2723	17	-4
106-046	0.76673	575	1.29	0.17872	0.00044226	12.1347	0.10781	0.49592	0.0038986	0.88481	2629	7	2615	8	2596	17	2
106-047	3.7314	603	0.2	0.17798	0.00042615	12.2989	0.0994	0.50531	0.003535	0.86557	2620	7	2627	8	2637	15	-1
106-048	3.2803	394	0.81	0.20389	0.00079838	12.6059	0.12651	0.45237	0.0038246	0.84245	2843	9	2651	9	2406	17	18
106-049	1.0059	442	1.6	0.1821	0.00052018	12.1515	0.095739	0.48906	0.0031017	0.80498	2655	8	2616	7	2567	13	4
106-050	0.31164	63	0.63	0.18315	0.0008567	12.5781	0.11554	0.50393	0.0036534	0.78925	2662	9	2649	9	2631	16	1
106-053	1.6811	112	0.81	0.1795	0.00065434	11.9771	0.099755	0.49017	0.0033597	0.82294	2627	8	2603	8	2571	15	3
106-054	5.1155	507	0.84	0.17827	0.00044855	11.7237	0.13127	0.48368	0.0050239	0.92761	2614	7	2583	10	2543	22	3
106-055	1.208	139	0.58	0.18477	0.0014237	11.1597	0.16278	0.44404	0.0052947	0.81746	2674	14	2537	14	2369	24	14
106-056	3.3694	288	0.37	0.20431	0.00090429	12.3436	0.10304	0.44347	0.0028333	0.76533	2841	9	2631	8	2366	13	20
106-058c	0.53868	183	1.46	0.17832	0.00056896	12.2386	0.10287	0.50299	0.0035616	0.84242	2620	8	2623	8	2627	15	0
106-058r	0.57242	1078	0.06	0.17977	0.00035626	12.5845	0.10213	0.51254	0.0035218	0.84668	2635	7	2649	8	2667	15	-2
106-059	1.3614	167	0.4	0.20159	0.00087282	12.807	0.11829	0.46444	0.0033477	0.78038	2826	9	2666	9	2459	15	16
106-062	0.76007	306	0.18	0.18509	0.00059835	12.5085	0.094934	0.49442	0.0029667	0.7906	2685	8	2643	7	2590	13	4

16CG106 (Menard, 2017) - Matinenda Formation - Drury Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
106-063	0.70597	250	0.34	0.18029	0.00055275	12.5345	0.1206	0.50901	0.0043219	0.8825	2640	8	2645	9	2652	18	-1
106-065	0.31808	271	0.14	0.18555	0.00072462	12.8002	0.11472	0.50543	0.0035984	0.79437	2686	9	2665	8	2637	15	2
106-066	1.4	438	0.03	0.17857	0.00047669	11.9254	0.096294	0.49044	0.0032447	0.81934	2619	8	2599	8	2573	14	2
106-071	0.88839	494	0.08	0.17985	0.00053708	12.6217	0.10786	0.51627	0.0037657	0.85349	2628	7	2652	8	2683	16	-3
106-072	0.22528	69	0.05	0.38198	0.0037321	41.2489	0.63905	0.79573	0.0092009	0.74635	3816	16	3801	15	3774	33	1
106-073	2.0587	519	0.04	0.1757	0.0005091	11.6311	0.098298	0.48861	0.0034173	0.82756	2583	8	2575	8	2565	15	1
106-075	2.163	1100	0.16	0.19592	0.00098324	12.2251	0.13236	0.46077	0.0040592	0.81369	2763	10	2622	10	2443	18	14
106-077	0.24375	212	0.12	0.18604	0.00089934	13.2358	0.11459	0.52472	0.0032961	0.72554	2680	10	2697	8	2719	14	-2
106-080	4.7459	1019	0.03	0.19256	0.00074026	12.5618	0.10006	0.48053	0.0028381	0.74151	2739	9	2647	7	2530	12	9
106-082	0.53535	155	0.16	0.17708	0.00094293	11.0078	0.12414	0.45735	0.0040759	0.79025	2602	12	2524	10	2428	18	8
106-083	3.1801	365	0.26	0.18734	0.00079437	13.7039	0.16387	0.53681	0.005514	0.85897	2700	10	2729	11	2770	23	-3
106-084	3.1225	414	0.26	0.18209	0.00054723	11.7517	0.095174	0.473	0.0030869	0.80582	2655	8	2585	8	2497	14	7
106-085	1.6226	174	1.26	0.17803	0.00070288	10.1992	0.090861	0.41932	0.0030051	0.80444	2619	9	2453	8	2257	14	16
106-086	1.3637	228	0.19	0.1829	0.00063633	12.1623	0.12115	0.48609	0.004131	0.85315	2666	9	2617	9	2554	18	5
106-087	0.68255	292	0.29	0.19099	0.00069505	13.6219	0.12045	0.51945	0.0036983	0.80515	2744	9	2724	8	2697	16	2
106-092	1.2015	565	0.35	0.19954	0.0010857	13.6079	0.11479	0.49551	0.0026061	0.62347	2819	11	2723	8	2594	11	10
106-098	1.3982	340	0.29	0.21491	0.0015218	13.3752	0.15957	0.45113	0.0038214	0.71003	2944	14	2707	11	2400	17	22
106-100	2.6794	250	0.22	0.17988	0.00065255	12.6326	0.11696	0.50908	0.0036659	0.77774	2653	10	2653	9	2653	16	0
106-103	2.5303	1390	0.06	0.17915	0.00042778	12.2679	0.095364	0.49757	0.0031364	0.81088	2642	8	2625	7	2603	13	2
106-104	11.3548	1997	0.52	0.18805	0.00055245	12.719	0.15425	0.49264	0.0054357	0.9098	2718	8	2659	11	2582	23	6
106-105	0.38661	110	1.72	0.18074	0.00072826	11.9844	0.10256	0.48475	0.0031069	0.74898	2646	9	2603	8	2548	13	5
106-106	0.90188	376	1.74	0.17629	0.00056203	11.4368	0.092006	0.4749	0.0030937	0.80977	2603	8	2559	8	2505	14	5
106-107	3.1203	396	0.2	0.18138	0.00056283	11.2472	0.10522	0.45449	0.0036239	0.85228	2648	8	2544	9	2415	16	11

16CG107 (Menard, 2017) – Ramsay Lake Formation - Drury Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	RhoXY	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	%Disc
107-001	0.47208	42	0.68	0.16436	0.0009492	9.531	0.11579	0.42383	0.0043302	0.84095	2488	11	2391	11	2278	20	10
107-005	1.6936	108	0.84	0.16633	0.0011236	9.0643	0.11501	0.39647	0.0040676	0.80855	2516	13	2345	12	2153	19	17
107-011	0.35355	40	0.4	0.16959	0.00098646	10.005	0.10142	0.43036	0.0033654	0.77141	2544	11	2435	9	2307	15	11
107-014	10.8522	250	0.38	0.17174	0.00068232	6.7879	0.06781	0.28832	0.0025059	0.87003	2565	8	2084	9	1633	13	41
107-015	1.743	104	0.84	0.17236	0.00068457	9.4372	0.089021	0.39904	0.0031373	0.83346	2573	9	2381	9	2165	14	19
107-018	2.5016	467	0.4	0.16803	0.00049593	10.3211	0.09226	0.44877	0.0033664	0.83916	2526	8	2464	8	2390	15	6
107-022	1.2896	112	0.61	0.16571	0.0010281	7.9118	0.14367	0.34932	0.0057844	0.9119	2500	13	2221	16	1931	28	26
107-025	0.2111	135	0.69	0.16886	0.00073777	10.9624	0.11923	0.47461	0.0041722	0.80829	2533	11	2520	10	2504	18	1
107-026	0.81121	86	0.58	0.17052	0.0009223	9.6637	0.10867	0.41427	0.0037153	0.79754	2550	11	2403	10	2234	17	15
107-028	0.38436	111	0.6	0.17097	0.0014943	9.1684	0.12603	0.39188	0.0037351	0.69339	2555	17	2355	13	2132	17	19
107-033	1.5896	237	0.89	0.17301	0.00063766	10.3027	0.098104	0.43242	0.003358	0.81553	2585	9	2462	9	2317	15	12
107-036	0.4901	36	0.41	0.16642	0.001467	10.3312	0.17808	0.44922	0.0063333	0.8179	2526	17	2465	16	2392	28	6
107-062	0.94281	54	0.37	0.17336	0.0010842	9.7954	0.14384	0.41163	0.0052419	0.86718	2583	12	2416	13	2222	24	16
107-012	0.18883	32	0.8	0.17677	0.00096677	11.2887	0.1132	0.46652	0.0036284	0.77561	2611	11	2547	9	2468	16	7
107-019	0.61565	205	0.68	0.17755	0.00065197	10.8188	0.11074	0.44572	0.0037013	0.81132	2616	10	2508	10	2376	16	11
107-037	0.18636	88	0.63	0.17637	0.00096449	11.2188	0.1165	0.46223	0.0037129	0.77351	2616	11	2541	10	2449	16	8
107-045	1.5013	318	0.57	0.17687	0.00058441	10.7576	0.089372	0.44275	0.0029312	0.79688	2618	8	2502	8	2363	13	12
107-016	0.19729	58	0.86	0.17742	0.00081798	11.5047	0.11966	0.47268	0.0040873	0.83134	2620	10	2565	10	2495	18	6
107-043	0.31914	94	1.33	0.17668	0.00087176	11.2452	0.14579	0.46141	0.0050514	0.84442	2623	12	2544	12	2446	22	8
107-020	0.201	101	0.7	0.17888	0.00090626	11.5551	0.12952	0.4729	0.0041513	0.78318	2627	12	2569	10	2496	18	6
107-039	0.24265	65	0.52	0.17818	0.00099442	11.5909	0.12729	0.47354	0.0040577	0.78025	2630	11	2572	10	2499	18	6
107-046	0.23359	79	1.89	0.17861	0.00089445	11.2146	0.11846	0.458	0.0038303	0.79175	2630	11	2541	10	2431	17	9
107-010	0.853	421	1.03	0.17842	0.00041429	12.3441	0.10265	0.50399	0.0037714	0.89988	2631	6	2631	8	2631	16	0
107-048	0.46752	367	0.46	0.17907	0.00056385	11.9782	0.11096	0.48896	0.0038731	0.8551	2631	8	2603	9	2566	17	3
107-035	0.98582	117	0.93	0.17767	0.00082186	11.7084	0.13921	0.47732	0.0047344	0.83422	2633	11	2581	11	2516	21	5
107-027	0.27957	136	0.95	0.1793	0.00081701	11.9683	0.12345	0.48787	0.0040507	0.80495	2634	10	2602	10	2561	18	3
107-050	0.26142	138	0.55	0.18007	0.00071302	12.2203	0.13582	0.49607	0.0047994	0.87049	2641	9	2621	10	2597	21	2
107-031	0.44276	79	0.41	0.18004	0.0010615	11.2918	0.13869	0.45733	0.004441	0.79062	2644	12	2548	11	2428	20	10
107-038	0.2105	171	0.72	0.17982	0.00075549	12.268	0.12023	0.4966	0.0039257	0.80665	2645	10	2625	9	2599	17	2
107-003	0.52	93	0.41	0.18011	0.00090967	11.0332	0.10491	0.44635	0.0033763	0.7955	2646	10	2526	9	2379	15	12
107-060	6.0993	126	0.62	0.18009	0.00069005	11.2758	0.11293	0.45544	0.003927	0.86095	2649	8	2546	9	2419	17	10
107-002	0.24762	358	0.11	0.18085	0.00091045	11.2143	0.14247	0.45252	0.0051284	0.89207	2650	10	2541	12	2406	23	11
107-051	0.19392	116	0.62	0.18138	0.00080497	12.4582	0.13071	0.50209	0.0042269	0.8024	2652	10	2640	10	2623	18	1
107-009	0.886	269	0.26	0.18081	0.00068024	11.7489	0.10571	0.47269	0.0035585	0.83668	2655	8	2585	8	2495	16	7
107-021	0.18892	320	1.46	0.182	0.00057215	12.66	0.10818	0.50909	0.0034443	0.79175	2656	9	2655	8	2653	15	0
107-023	0.29481	160	0.85	0.18234	0.00075385	12.2087	0.12068	0.48971	0.00375	0.77469	2660	10	2621	9	2569	16	4
107-044	0.39032	77	0.44	0.18119	0.00099206	11.9366	0.14311	0.47857	0.0047147	0.82173	2661	11	2599	11	2521	21	6
107-052	7.0138	111	0.46	0.18215	0.00083372	12.0787	0.12779	0.48421	0.0040997	0.80027	2661	11	2611	10	2546	18	5
107-040	0.18987	83	0.73	0.18139	0.00088686	12.3604	0.12602	0.49528	0.0040254	0.79718	2662	10	2632	10	2593	17	3
107-013r	2.0124	261	0.14	0.18252	0.00048518	11.7594	0.093206	0.47089	0.0031775	0.85134	2663	7	2585	7	2487	14	8
107-032	0.17917	160	1.18	0.18216	0.0007528	12.373	0.11874	0.49427	0.0037726	0.79537	2667	10	2633	9	2589	16	4
107-053	0.15244	48	0.49	0.183	0.00091662	12.6454	0.13617	0.504	0.0044392	0.81795	2671	10	2654	10	2631	19	2

16CG107 (Menard, 2017) – Ramsay Lake Formation - Drury Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig 1	206Pb/ 238U	Sig1	%Disc
107-054	0.379	147	0.3	0.18496	0.00063973	12.1108	0.098971	0.47701	0.0031598	0.81057	2690	8	2613	8	2514	14	8
107-042	0.16529	243	0.52	0.18401	0.00064295	12.3446	0.1276	0.48611	0.0040893	0.81382	2691	10	2631	10	2554	18	6
107-013c	0.23135	72	0.84	0.18559	0.00082153	12.1801	0.11614	0.4792	0.0038109	0.834	2692	9	2618	9	2524	17	8
107-056	0.17544	39	0.4	0.18554	0.0010257	12.6703	0.14096	0.49691	0.0044701	0.80856	2698	11	2655	10	2601	19	4
107-034	0.86631	114	0.45	0.18563	0.00088889	12.545	0.1326	0.48972	0.0040037	0.77347	2705	11	2646	10	2569	17	6
107-061	2.7942	52	0.33	0.18695	0.0014687	12.5788	0.14791	0.48978	0.0039875	0.69236	2709	14	2649	11	2570	17	6
107-041	0.28462	222	0.61	0.18746	0.00076279	13.1188	0.13051	0.50786	0.0041202	0.81553	2719	9	2688	9	2647	18	3

16CG107 – Ramsay Lake Formation - Drury Township… Redated

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
50.1	0.26142	138	0.55	0.18007	0.0007130	12.22033	0.13582	0.49607	0.0047994	0.87049	2641	9	2621	10	2597	21	2
50.6	2.156	149	1.2	0.1744	0.0011822	11.051	0.16126	0.4559	0.0055202	0.82977	2614	14	2527	14	2421	24	9
50.8	0.30785	146	1.13	0.17558	0.00083768	12.1286	0.15352	0.49939	0.0053419	0.84511	2617	11	2614	12	2611	23	0
50.3	0.3105	107	0.89	0.17625	0.00086684	12.3599	0.15288	0.50608	0.0053532	0.85517	2626	11	2632	12	2640	23	-1
50.7	0.48649	126	1.2	0.17619	0.0012126	11.1293	0.22048	0.45378	0.0080929	0.90024	2633	14	2534	18	2412	36	10
50.5	3.3378	136	1.37	0.17849	0.00087673	11.6734	0.14737	0.47128	0.0050623	0.85086	2650	11	2579	12	2489	22	7
50.4	5.7061	107	1.47	0.18101	0.00074646	11.976	0.14545	0.47784	0.0049151	0.84696	2669	11	2603	11	2518	21	7
50.4	7.3673	142	0.46	0.18157	0.001686	8.6094	0.11605	0.34191	0.0030899	0.67043	2677	16	2298	12	1896	15	34
53.1	0.15244	48	0.49	0.183	0.00091662	12.6454	0.13617	0.504	0.0044392	0.81795	2671	10	2654	10	2631	19	2
53.9	0.41184	109	0.53	0.16603	0.0010835	9.7533	0.13766	0.42732	0.0047533	0.7881	2513	15	2412	13	2294	21	10
53.6	0.7185	169	0.9	0.17566	0.00082642	11.0698	0.15211	0.45852	0.0053833	0.8544	2607	12	2529	13	2433	24	8
53.7	0.37732	136	0.67	0.17558	0.00095448	11.5715	0.19167	0.47915	0.0071375	0.89931	2607	12	2570	15	2524	31	4
53.5	0.32965	130	0.84	0.17602	0.00091323	11.3226	0.13425	0.46864	0.0044457	0.80006	2608	12	2550	11	2478	20	6
53.2	0.31013	102	0.93	0.17846	0.00097255	11.9168	0.14461	0.48462	0.0046395	0.78894	2638	12	2598	11	2547	20	4
53.4	0.29428	133	0.81	0.17958	0.00094536	11.7209	0.13371	0.47612	0.0041603	0.76593	2639	12	2582	11	2510	18	6
53.8	0.82237	157	0.89	0.17938	0.00084888	12.0389	0.17644	0.48807	0.0063275	0.88458	2643	11	2607	14	2562	27	4
53.3	0.246	101	0.93	0.18188	0.00095599	12.7612	0.17892	0.51119	0.0058928	0.82218	2663	13	2662	13	2662	25	0
53.1	0.29158	160	1.01	0.18135	0.00091971	12.6551	0.15813	0.50535	0.0051901	0.82195	2668	12	2654	12	2637	22	1
53.11	1.3623	139	0.81	0.18123	0.00090487	11.6861	0.1466	0.46583	0.0046817	0.80115	2671	12	2580	12	2465	21	9
1.1	0.472078	42	0.68	0.16436	0.00094924	9.531	0.11579	0.42383	0.0043302	0.84095	2488	11	2391	11	2278	20	10
1.2	0.44762	115	1.14	0.17385	0.00083997	10.8454	0.11158	0.45516	0.0036096	0.77082	2585	11	2510	10	2418	16	8
1.3	1.2671	170	0.87	0.16302	0.00075662	9.1575	0.098632	0.41026	0.0035893	0.81228	2475	11	2354	10	2216	16	12
1.4	1.7966	123	0.78	0.16894	0.00083573	10.5429	0.16958	0.45623	0.0066478	0.90589	2534	11	2484	15	2423	29	5
1.5	0.41636	137	0.94	0.17791	0.00084575	12.6423	0.1375	0.51704	0.0044801	0.79667	2628	11	2653	10	2687	19	-3
5.1	1.6936	108	0.84	0.16633	0.0011236	9.0643	0.11501	0.39647	0.0040676	0.80855	2516	13	2345	12	2153	19	17
5.2	0.61655	174	0.73	0.17282	0.0010455	11.8181	0.14292	0.49468	0.0047223	0.78937	2589	12	2590	11	2591	20	0
5.3	3.1347	255	1.06	0.16801	0.00066947	10.5281	0.13497	0.45065	0.0049947	0.86456	2552	11	2482	12	2398	22	7
11.1	0.35355	40	0.4	0.16959	0.00098646	10.005	0.10142	0.43036	0.0033654	0.77141	2544	11	2435	9	2307	15	11
11.2	0.19153	81	0.76	0.18195	0.00094209	13.1318	0.15657	0.51788	0.0050748	0.82187	2688	11	2689	11	2690	22	0
11.3	0.15637	54	0.48	0.18125	0.001135	12.7408	0.14863	0.50536	0.0045439	0.77076	2679	12	2661	11	2637	19	2
11.4	0.18048	75	0.52	0.18182	0.00095968	12.6874	0.14244	0.50259	0.0044973	0.79707	2681	11	2657	11	2625	19	3
11.5	0.19245	63	0.55	0.17672	0.001003	11.344	0.12433	0.4649	0.0039123	0.76781	2625	12	2552	10	2461	17	7
11.6	0.41361	100	0.62	0.17153	0.00091746	10.4805	0.12803	0.44333	0.0044071	0.81373	2572	12	2478	11	2366	20	10
11.7	0.19253	88	1.4	0.17592	0.001059	11.9016	0.14254	0.4918	0.0042543	0.72229	2611	14	2597	11	2578	18	2
11.8	0.24336	93	0.97	0.17535	0.0014892	11.4982	0.17867	0.47631	0.0056331	0.7611	2607	17	2564	14	2511	25	4
11.9	0.46289	86	1.2	0.17409	0.0011401	11.7265	0.14859	0.48801	0.0048279	0.78075	2599	13	2583	12	2562	21	2
11.1	0.56354	111	0.77	0.16624	0.00090262	10.39	0.11512	0.45161	0.0038696	0.77336	2526	12	2470	10	2402	17	6
11.11	1.9338	106	0.97	0.16863	0.00088168	10.8626	0.11189	0.46688	0.003682	0.7656	2545	11	2511	10	2470	16	4

16CG107 – Ramsay Lake Formation - Drury Township… Redated… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
11.12	1.8536	191	0.76	0.1639	0.00078549	10.4715	0.13915	0.46438	0.0054094	0.87661	2493	11	2477	12	2459	24	2
14.1	10.8522	250	0.38	0.17174	0.00068232	6.7879	0.06781	0.28832	0.0025059	0.87003	2565	8	2084	9	1633	13	41
14.2	0.61339	192	0.55	0.1735	0.00071651	10.8675	0.12275	0.45654	0.0042358	0.8214	2583	11	2512	10	2424	19	7
14.3	0.48441	223	0.62	0.17617	0.00073908	11.1451	0.14571	0.46143	0.0052676	0.87317	2608	11	2535	12	2446	23	7
15.1	1.743	104	0.84	0.17236	0.00068457	9.4372	0.089021	0.39904	0.0031373	0.83346	2573	9	2381	9	2165	14	19
15.2	1.5016	262	0.83	0.17189	0.00058851	11.7422	0.11492	0.49722	0.0039966	0.82132	2570	9	2584	9	2602	17	-1
15.3	1.7743	283	1.11	0.17417	0.00086376	10.9877	0.16821	0.45823	0.0062203	0.88671	2596	12	2522	14	2432	27	8
18.1	2.5016	467	0.4	0.16803	0.00049593	10.3211	0.09226	0.44877	0.0033664	0.83916	2526	8	2464	8	2390	15	6
18.2	1.2194	395	0.45	0.17306	0.00062369	11.6031	0.14091	0.48636	0.0051993	0.88029	2587	10	2573	11	2555	23	2
22.1	1.2896	112	0.61	0.16571	0.0010281	7.9118	0.14367	0.34932	0.0057844	0.9119	2500	13	2221	16	1931	28	26
22.2	1.5494	121	0.38	0.16712	0.0012743	7.7199	0.09766	0.33522	0.0030608	0.72178	2528	15	2199	11	1864	15	30
22.3	0.83947	156	0.46	0.17417	0.00081437	10.5716	0.12803	0.44063	0.0044524	0.83434	2597	11	2486	11	2353	20	11
25.1	0.2111	135	0.69	0.16886	0.00073777	10.9624	0.11923	0.47461	0.0041722	0.80829	2533	11	2520	10	2504	18	1
25.2	0.30687	159	0.53	0.17054	0.001139	10.2247	0.13231	0.43411	0.0043943	0.78222	2566	13	2455	12	2324	20	11
26.1	0.81121	86	0.58	0.17052	0.0009223	9.6637	0.10867	0.41427	0.0037153	0.79754	2550	11	2403	10	2234	17	15
26.2	1.9673	102	0.66	0.1604	0.0012779	8.1957	0.10228	0.36888	0.0032322	0.70208	2468	15	2253	11	2024	15	21
26.3	0.92502	105	0.93	0.16225	0.0011595	7.2202	0.090081	0.3203	0.0029759	0.7447	2492	14	2139	11	1791	15	32
26.4	0.64083	113	1.11	0.16542	0.0010817	7.9768	0.12009	0.34464	0.004432	0.85416	2536	13	2228	14	1909	21	29
26.5	0.47976	227	0.47	0.18139	0.0010502	12.0751	0.14658	0.47481	0.0045309	0.78611	2693	12	2610	11	2505	20	8
26.6	1.1648	109	0.89	0.17221	0.0012283	9.6399	0.1245	0.39844	0.0036207	0.7036	2611	15	2401	12	2162	17	20
26.7	0.29233	149	0.67	0.1781	0.00091593	12.1596	0.15541	0.48943	0.00502	0.80253	2655	13	2617	12	2568	22	4
28.1	0.38436	111	0.6	0.17097	0.0014943	9.1684	0.12603	0.39188	0.0037351	0.69339	2555	17	2355	13	2132	17	19
28.2	0.95203	246	0.79	0.17165	0.00094109	10.4929	0.13293	0.44223	0.0044963	0.80255	2578	13	2479	12	2361	20	10
28.3	3.0942	314	0.66	0.16611	0.001021	9.7412	0.13327	0.42809	0.004565	0.77942	2508	14	2411	13	2297	21	10
28.4	2.1056	198	0.87	0.16253	0.0010737	9.076	0.1361	0.40806	0.0050421	0.82396	2469	14	2346	14	2206	23	13
28.5	0.63016	127	1.05	0.17277	0.0012775	11.58	0.18852	0.48787	0.0066119	0.83246	2579	15	2571	15	2561	29	1
33.1	1.5896	237	0.89	0.17301	0.00063766	10.3027	0.098104	0.43242	0.003358	0.81553	2585	9	2462	9	2317	15	12
33.2	0.64183	309	1.21	0.16372	0.00071522	9.0226	0.11899	0.39954	0.004405	0.836	2495	12	2340	12	2167	20	15
33.3	0.43797	166	0.79	0.16943	0.00070694	11.1559	0.13554	0.47818	0.0049744	0.85623	2550	11	2536	11	2519	22	1
33.4	4.0342	185	0.69	0.17682	0.00072239	10.4501	0.1082	0.4304	0.0036652	0.82249	2616	10	2475	10	2308	17	14
33.5	2.9622	196	0.71	0.17004	0.00072078	9.6418	0.10399	0.41411	0.0036639	0.82037	2546	10	2401	10	2234	17	15
33.6	0.43032	121	0.92	0.16904	0.00087992	10.1884	0.12307	0.43997	0.0044418	0.83579	2537	11	2452	11	2350	20	9
33.7	0.85995	168	0.78	0.16333	0.00083325	9.2655	0.10086	0.41344	0.0035304	0.78446	2482	11	2365	10	2231	16	12
33.8	0.55782	124	1.14	0.17376	0.00097015	11.1523	0.14354	0.46699	0.0048235	0.80254	2589	13	2536	12	2470	21	6
36.1	0.4901	36	0.41	0.16642	0.001467	10.3312	0.17808	0.44922	0.0063333	0.8179	2526	17	2465	16	2392	28	6
36.2	0.23092	44	0.57	0.1708	0.0018096	10.3671	0.1729	0.44401	0.0053325	0.7201	2551	19	2468	15	2369	24	9
36.3	2.8371	75	0.47	0.1583	0.0014142	6.9313	0.095123	0.32141	0.0029943	0.67883	2417	17	2103	12	1797	15	29
36.4	3.0796	99	0.37	0.14078	0.0010287	6.8034	0.1021	0.35597	0.0042638	0.79816	2210	16	2086	13	1963	20	13
36.5	6.7244	82	0.36	0.16804	0.0012356	8.1918	0.10797	0.35956	0.0035269	0.74423	2510	15	2252	12	1980	17	24
62.1	0.94281	54	0.37	0.17336	0.0010842	9.7954	0.14384	0.41163	0.0052419	0.86718	2583	12	2416	13	2222	24	16
62.2	3.6638	114	0.25	0.16596	0.0011042	8.1221	0.10823	0.36017	0.003761	0.78365	2493	14	2245	12	1983	18	24
62.3	0.93026	89	0.5	0.16412	0.0011768	7.6733	0.12294	0.34213	0.0045706	0.8338	2484	15	2193	14	1897	22	27

16CG107 – Ramsay Lake Formation - Drury Township… Redated… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
62.4	1.0052	132	0.68	0.16811	0.0011105	7.2372	0.12285	0.31388	0.0047195	0.8858	2530	13	2141	15	1760	23	35

16CG108 (Menard, 2017) – Ramsay Lake Formation – Baldwin Township

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	RhoXY	207Pb/206Pb	Sig1	207Pb/235U	Sig1	206Pb/238U	Sig1	%Disc
108-001	0.15553	159	0.19	0.18113	0.0005983	12.7522	0.1207	0.51675	0.0041429	0.84701	2643	8	2662	9	2685	18	-2
108-002	0.17919	18	0.23	0.19162	0.001439	14.1192	0.17414	0.54001	0.0049915	0.74946	2739	13	2758	12	2783	21	-2
108-003	1.1503	425	0.31	0.18384	0.0004828	13.1889	0.11789	0.52496	0.004197	0.89445	2673	7	2693	8	2720	18	-2
108-004	0.19186	316	0.3	0.20225	0.00052804	15.5628	0.136	0.56218	0.0043076	0.8768	2833	7	2850	8	2876	18	-2
108-005	1.4655	192	0.41	0.1967	0.00097442	13.3639	0.12169	0.49596	0.0034189	0.75701	2788	10	2706	9	2596	15	8
108-006	0.22661	181	0.42	0.1847	0.00054019	13.0543	0.10591	0.51632	0.0035824	0.85524	2684	7	2684	8	2684	15	0
108-007	0.27836	160	0.22	0.18383	0.00066544	13.2096	0.11079	0.5253	0.0035967	0.81638	2675	8	2695	8	2722	15	-2
108-008	2.9848	1037	0.37	0.18405	0.00043069	12.9007	0.10698	0.51276	0.0035798	0.84187	2675	7	2672	8	2668	15	0
108-009	0.2101	169	0.4	0.18182	0.00064836	12.6644	0.12059	0.50936	0.004049	0.83482	2656	9	2655	9	2654	17	0
108-010	0.99366	469	0.06	0.18694	0.00051627	13.6312	0.13199	0.53268	0.0046117	0.89408	2704	7	2724	9	2753	19	-2
108-011	0.14723	37	0.15	0.18896	0.001043	13.6203	0.1469	0.52602	0.0045521	0.80235	2723	11	2724	10	2725	19	0
108-012	0.14708	62	0.53	0.18681	0.00082059	13.1754	0.13337	0.51416	0.0042718	0.82075	2706	10	2692	10	2674	18	1
108-013	0.77133	79	0.34	0.19051	0.00083418	13.7413	0.12801	0.52591	0.003851	0.78602	2738	9	2732	9	2724	16	1
108-014	0.31229	63	0.26	0.18655	0.00086174	13.2409	0.13181	0.51813	0.0042534	0.82465	2701	9	2697	9	2691	18	0
108-015	0.19055	104	0.38	0.18371	0.00065235	13.1598	0.12196	0.52354	0.0041701	0.85947	2674	8	2691	9	2714	18	-2
108-016	0.27085	259	0.41	0.18488	0.00052443	13.2968	0.1212	0.52627	0.0041658	0.86843	2682	7	2701	9	2726	18	-2
108-017	0.43189	176	0.51	0.18371	0.00059588	13.1358	0.11521	0.52272	0.0038435	0.83835	2674	8	2689	8	2711	16	-2
108-018	0.34352	164	0.6	0.18602	0.00063189	12.7868	0.099823	0.50142	0.0031628	0.80798	2698	8	2664	7	2620	14	4
108-019	0.16626	115	0.46	0.18374	0.00071436	13.1576	0.1175	0.52125	0.0038577	0.82877	2681	8	2691	8	2704	16	-1
108-020	0.25271	67	0.54	0.18961	0.00085524	13.766	0.14494	0.52733	0.00464	0.83573	2736	10	2734	10	2730	20	0
108-021	0.2252	241	0.53	0.18853	0.00055125	14.5279	0.14967	0.5588	0.0051345	0.89191	2730	8	2785	10	2862	21	-6
108-022	0.82738	261	0.49	0.18364	0.00052731	13.4375	0.12004	0.53093	0.0041645	0.87802	2685	7	2711	8	2745	18	-3
108-023	0.1679	104	0.08	0.18271	0.00070074	13.3279	0.11911	0.52955	0.0039335	0.8312	2676	8	2703	8	2740	17	-3
108-024	4.2461	267	1.16	0.17897	0.00057609	12.0322	0.099753	0.48833	0.0032905	0.81277	2641	8	2607	8	2563	14	4
108-025	0.18431	66	0.24	0.18409	0.00092511	13.1592	0.13461	0.52002	0.004238	0.79669	2685	10	2691	10	2699	18	-1
108-026	0.523	113	0.6	0.18616	0.000712	12.5928	0.14057	0.4926	0.0049234	0.89535	2702	8	2650	10	2582	21	5
108-027	0.15462	45	0.16	0.18893	0.0010169	14.0442	0.14061	0.54183	0.0042297	0.77972	2725	10	2753	9	2791	18	-3
108-028	3.0823	167	0.2	0.18866	0.0006337	12.988	0.10296	0.50229	0.0030917	0.77645	2721	8	2679	7	2624	13	4
108-029	0.33356	57	0.27	0.1906	0.0010684	13.2585	0.13315	0.50781	0.0037714	0.73955	2737	11	2698	9	2647	16	4
108-030	0.23846	231	0.49	0.18263	0.00065591	12.9265	0.1128	0.51647	0.0036706	0.81443	2667	8	2674	8	2684	16	-1
108-031	0.16786	115	0.77	0.18344	0.00073284	12.451	0.11183	0.49507	0.0034718	0.78084	2675	9	2639	8	2593	15	4
108-032	0.21625	200	0.36	0.18645	0.00069773	12.9716	0.12182	0.5072	0.0036431	0.76479	2703	10	2678	9	2645	16	3
108-033	1.5626	192	0.23	0.1879	0.0007111	12.8293	0.12658	0.49736	0.0038635	0.78728	2717	10	2667	9	2602	17	5
108-034	0.17973	109	0.43	0.18467	0.0008111	12.9746	0.13797	0.51162	0.0045195	0.83073	2689	10	2678	10	2664	19	1
108-035	0.16537	70	0.58	0.18795	0.00084915	13.5704	0.12763	0.52561	0.0038921	0.78736	2718	10	2720	9	2723	16	0
108-036	0.30833	161	0.48	0.18544	0.00057146	13.2582	0.11802	0.52028	0.0038468	0.83059	2697	8	2698	8	2700	16	0
108-037	0.14737	63	0.23	0.18955	0.00088045	13.3205	0.12346	0.51114	0.0036052	0.76102	2734	10	2703	9	2662	15	3
108-038	0.16871	151	0.38	0.18148	0.0006901	12.8466	0.10856	0.51481	0.0034834	0.80071	2662	8	2668	8	2677	15	-1

16CG108 (Menard, 2017) – Ramsay Lake Formation – Baldwin Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb /238U	Sig1	%Disc
108-039	0.27762	176	0.24	0.19095	0.00064713	14.889	0.15052	0.56699	0.0050573	0.88226	2746	8	2808	10	2895	21	-7
108-040	0.20504	115	0.42	0.18874	0.00067227	13.6928	0.11691	0.52748	0.0035633	0.79124	2727	9	2729	8	2731	15	0
108-041	0.25774	97	0.54	0.18962	0.00077457	13.8217	0.12698	0.53033	0.0038643	0.79313	2734	9	2738	9	2743	16	0
108-042	0.63175	64	0.32	0.20725	0.0010075	14.9281	0.29421	0.52447	0.009859	0.95381	2878	10	2811	19	2718	42	7
108-043	5.2413	358	0.72	0.20027	0.00099836	10.9019	0.2174	0.39666	0.0075371	0.95286	2821	10	2515	18	2154	35	28
108-044	0.37386	160	0.33	0.18687	0.00061109	13.3112	0.12462	0.51945	0.004068	0.83651	2706	8	2702	9	2697	17	0
108-045	0.23276	289	0.42	0.18636	0.00048316	13.2631	0.11704	0.51898	0.0038538	0.84146	2701	8	2699	8	2695	16	0
108-046	0.15624	28	0.35	0.18315	0.0011367	13.2581	0.14999	0.52745	0.0046028	0.77137	2674	12	2698	11	2731	19	-3
108-047	0.18776	79	0.41	0.18913	0.00087088	13.329	0.12653	0.5131	0.0037701	0.77403	2728	10	2703	9	2670	16	3
108-048	0.1743	76	0.26	0.18953	0.0009115	13.3983	0.13635	0.51427	0.0039701	0.7586	2733	11	2708	10	2675	17	3
108-049	0.32118	75	0.55	0.18959	0.0009044	12.2287	0.1224	0.46934	0.003529	0.75123	2733	11	2622	9	2481	15	11
108-050	0.16082	70	0.17	0.18739	0.00088694	12.7983	0.12177	0.49746	0.0036207	0.76495	2712	10	2665	9	2603	16	5
108-051	0.17486	115	0.58	0.18427	0.00068117	13.1025	0.12461	0.51843	0.0041125	0.8341	2683	9	2687	9	2693	17	0
108-052	0.16605	64	0.3	0.19003	0.00095798	14.0035	0.1618	0.53783	0.0051341	0.82617	2732	11	2750	11	2774	22	-2
108-053	0.16602	74	0.68	0.18312	0.0008226	12.8348	0.13242	0.5121	0.0042749	0.80914	2669	10	2668	10	2666	18	0
108-054	0.25769	120	0.46	0.18714	0.00073961	13.0362	0.11818	0.50902	0.0037471	0.81201	2705	9	2682	9	2652	16	2
108-055	0.18496	139	0.41	0.18419	0.00066687	13.0509	0.12667	0.51781	0.0043082	0.85721	2678	8	2683	9	2690	18	-1
108-056	0.16709	109	0.48	0.18489	0.00071841	13.5129	0.1376	0.53415	0.0045802	0.84208	2685	9	2716	10	2759	19	-3
108-057	0.20986	278	0.52	0.18615	0.00052571	12.8881	0.10731	0.50556	0.0034391	0.81699	2697	8	2672	8	2638	15	3
108-058	0.29813	109	0.35	0.18351	0.00073981	11.7146	0.093269	0.46566	0.0027659	0.74604	2675	9	2582	7	2465	12	9
108-059	0.19161	110	0.31	0.18834	0.00077943	13.3418	0.12355	0.51621	0.0038741	0.81043	2720	9	2704	9	2683	16	2
108-060	0.20133	145	0.99	0.1817	0.00068152	13.2172	0.12336	0.52953	0.0039835	0.806	2662	9	2695	9	2739	17	-4
108-061	0.1809	192	0.56	0.18299	0.00061273	12.8314	0.11379	0.51029	0.0036393	0.80422	2675	9	2667	8	2658	16	1
108-062	0.20545	52	0.39	0.18497	0.00092817	13.2569	0.13303	0.52193	0.0041355	0.78961	2691	10	2698	9	2707	18	-1
108-063	0.32738	192	0.91	0.18222	0.00066408	12.4913	0.108	0.49953	0.0034848	0.80691	2665	8	2642	8	2612	15	2
108-064	0.18455	306	0.53	0.18496	0.00053664	13.0661	0.1174	0.51515	0.00384	0.82963	2689	8	2684	8	2679	16	0
108-065	4.7345	232	0.91	0.18919	0.00085225	11.6762	0.15061	0.45022	0.0051243	0.8824	2726	10	2579	12	2396	23	14
108-066	0.16686	96	0.41	0.18539	0.00079485	12.9121	0.11824	0.50792	0.0037141	0.79852	2693	9	2673	9	2648	16	2
108-067	0.25233	224	0.58	0.18343	0.00054776	13.0129	0.10643	0.51719	0.0035461	0.8383	2676	7	2681	8	2687	15	-1
108-068	0.16353	53	0.26	0.19595	0.00095998	14.2838	0.14476	0.53126	0.004292	0.79718	2785	10	2769	10	2747	18	2
108-069	0.49247	136	0.33	0.18968	0.0007614	12.4508	0.10362	0.47875	0.0030197	0.7579	2730	9	2639	8	2522	13	9
108-070	1.0511	102	1.16	0.18715	0.00086949	10.5734	0.095876	0.41251	0.0029142	0.77908	2706	9	2486	8	2226	13	21
108-071	0.17577	112	0.24	0.19076	0.00071549	13.8594	0.13348	0.53104	0.004353	0.85111	2736	8	2740	9	2746	18	0
108-072	0.45235	149	0.47	0.1845	0.00066847	12.3214	0.14195	0.48868	0.0049825	0.88503	2679	9	2629	11	2565	22	5
108-073	0.17442	61	0.34	0.19163	0.00084111	14.2623	0.15128	0.54469	0.0047935	0.82968	2741	10	2767	10	2803	20	-3
108-074	0.14968	97	0.24	0.18386	0.0008516	12.776	0.12108	0.5081	0.0038097	0.79116	2675	10	2663	9	2649	16	1
108-075	0.19483	118	0.57	0.18905	0.00072711	13.2736	0.12	0.51292	0.0037953	0.81844	2722	9	2699	9	2669	16	2
108-076	0.35348	154	0.62	0.18262	0.00072841	12.133	0.11019	0.48492	0.0034496	0.78331	2666	9	2615	9	2549	15	5
108-077	0.19304	128	0.32	0.18269	0.00068321	12.5785	0.11364	0.50191	0.003577	0.78884	2669	9	2649	8	2622	15	2

16CG108 (Menard, 2017) – Ramsay Lake Formation – Baldwin Township… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb /238U	Sig1	%Disc
108-078	0.16335	64	0.28	0.18869	0.0011123	13.3578	0.15529	0.51586	0.0047502	0.79206	2723	12	2705	11	2682	20	2
108-079	0.14952	43	0.45	0.18836	0.001271	13.0593	0.1601	0.50504	0.0046557	0.75193	2721	13	2684	12	2635	20	4
108-080	0.24858	320	0.69	0.18412	0.00061245	12.3713	0.12837	0.48931	0.0040129	0.79036	2684	11	2633	10	2568	17	5

Additional Samples Redated

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
JAM001-2.1	0.31489	865	0.05	0.17968	0.00075195	12.8788	0.13411	0.51496	0.0044636	0.83238	2666	10	2671	10	2678	19	-1
JAM001-2.3	4.6428	869	0.06	0.18047	0.00034374	12.9206	0.10848	0.5176	0.0040923	0.94173	2662	5	2674	8	2689	17	-1
JAM001-2.4	1.1613	926	0.07	0.18026	0.00033644	12.6203	0.093634	0.50574	0.0034648	0.9234	2662	5	2652	7	2638	15	1
JAM001-2.5	1.4164	934	0.07	0.1801	0.00029461	12.9066	0.10887	0.51724	0.0040926	0.93802	2662	5	2673	8	2687	17	-1
JAM001-2.7	0.82208	1247	0.06	0.17946	0.00025291	12.6298	0.09982	0.5061	0.0036702	0.91756	2662	5	2652	7	2640	16	1
JAM001-2.2	0.6017	878	0.05	0.18104	0.00035703	12.9329	0.088798	0.51691	0.0031959	0.90048	2666	5	2675	6	2686	14	-1
JAM001-2.6	4.2038	1140	0.08	0.18162	0.00038039	12.879	0.11963	0.51043	0.0044403	0.93656	2680	5	2671	9	2658	19	1
JAM001-3.1	0.183	92	0.79	0.18076	0.001002	12.4963	0.14503	0.4968	0.004688	0.8131	2675	11	2642	11	2600	20	3
JAM001-3.4	2.5402	380	0.7	0.17715	0.00061253	11.4051	0.1059	0.4623	0.0036205	0.84343	2643	8	2557	9	2450	16	9
JAM001-3.6	0.77152	267	0.59	0.17777	0.00039406	12.307	0.10343	0.49775	0.0036279	0.86722	2647	7	2628	8	2604	16	2
JAM001-3.7	1.2583	380	0.57	0.17885	0.00045289	12.3053	0.11814	0.495	0.0041276	0.86857	2656	8	2628	9	2592	18	3
JAM001-3.2	1.0372	188	0.81	0.1804	0.00048817	12.5831	0.11497	0.50116	0.0040356	0.88134	2672	7	2649	9	2619	17	2
JAM001-3.3	2.7244	387	0.76	0.18195	0.00054956	12.3897	0.12231	0.48877	0.0041426	0.85859	2688	8	2634	9	2565	18	6
JAM001-3.8	2.1708	327	0.5	0.18279	0.00063673	11.4683	0.18722	0.452	0.006996	0.9481	2689	9	2562	15	2404	31	13
JAM001-3.5	3.8021	228	0.51	0.18868	0.00073101	12.5585	0.14447	0.47824	0.0049199	0.89426	2746	8	2647	11	2520	21	10
JAM001-4.1	0.27072	226	1.59	0.18188	0.00084146	125.7774	0.14302	0.50497	0.0047214	0.83532	2685	10	2663	11	2635	20	2
JAM001-4.4	2.074	435	0.75	0.17938	0.00039277	12.4082	0.10345	0.49941	0.0037365	0.89736	2655	6	2636	8	2611	16	2
JAM001-4.8	2.747	202	0.96	0.17984	0.0003493	12.4182	0.097672	0.49979	0.00365	0.92853	2655	5	2637	7	2613	16	2
JAM001-4.5	2.017	297	0.95	0.18049	0.00042396	12.6621	0.10486	0.50723	0.0038267	0.91099	2663	6	2655	8	2645	16	1
JAM001-4.6	2.514	265	0.74	0.18104	0.00033847	12.508	0.084011	0.4997	0.0030381	0.90518	2667	5	2643	6	2613	13	2
JAM001-4.7	2.7244	224	1.07	0.18283	0.00035592	12.9268	0.08206	0.51157	0.0029082	0.89554	2683	5	2674	6	2663	12	1
JAM001-4.3	2.9474	260	1.17	0.1843	0.00045461	12.9879	0.11838	0.50845	0.0042231	0.91124	2701	6	2679	9	2650	18	2
JAM001-4.2	1.698	255	0.95	0.18465	0.00041888	12.9333	0.11854	0.50498	0.0041897	0.90519	2705	6	2675	9	2635	18	3
JAM001-5.1	0.16304	54	0.85	0.1786	0.0012049	12.2671	0.16596	0.49381	0.0053432	0.79979	2654	13	2625	13	2587	23	3
JAM001-5.2	1.4309	82	0.45	0.17896	0.00050399	12.2877	0.10498	0.4964	0.0038428	0.90606	2649	6	2627	8	2598	17	2
JAM001-5.5	1.3558	130	0.55	0.17886	0.00059059	12.3657	0.12902	0.49871	0.0045537	0.8751	2651	8	2633	10	2608	20	2
JAM001-5.4	0.69408	113	0.6	0.17966	0.00046554	12.3814	0.10716	0.49749	0.0037971	0.88187	2657	7	2634	8	2603	16	2
JAM001-5.6	1.5742	158	0.66	0.17912	0.00058715	12.2569	0.10634	0.49242	0.0036156	0.84632	2658	8	2624	8	2581	16	3
JAM001-5.3	0.53428	106	0.51	0.18068	0.00044682	12.85	0.095184	0.51379	0.0033284	0.87455	2666	6	2669	7	2673	14	0
JAM001-5.7	0.87782	237	0.98	0.18122	0.00041188	12.8231	0.10015	0.50878	0.0035101	0.88339	2678	6	2667	7	2651	15	1
JAM001-5.9	0.77305	132	0.74	0.18096	0.00063625	12.4486	0.12401	0.49381	0.0043607	0.88643	2679	8	2639	9	2587	19	4
JAM001-5.8	1.0737	137	0.6	0.18339	0.00044248	13.2272	0.10906	0.51815	0.0038255	0.89542	2700	6	2696	8	2691	16	0
JAM002-4.1	0.28452	99	0.35	0.1805	0.00094699	12.7633	0.15144	0.50931	0.0049943	0.82642	2669	11	2662	11	2654	21	1
JAM002-4.8	1.3576	142	0.45	0.17967	0.00052812	11.565	0.095895	0.46539	0.0034526	0.89471	2655	6	2570	8	2463	15	9
JAM002-4.7	3.096	116	0.4	0.18006	0.00052191	11.8623	0.10055	0.47598	0.0036424	0.90277	2660	6	2594	8	2510	16	7
JAM002-4.6	1.9855	165	0.48	0.18014	0.00045975	12.1169	0.093648	0.48561	0.0033444	0.89109	2662	6	2613	7	2552	15	5
JAM002-4.9	0.76738	81	0.36	0.18134	0.00056943	12.4001	0.10595	0.49477	0.003729	0.8821	2669	7	2635	8	2591	16	4
JAM002-4.4	1.3757	157	0.53	0.18215	0.00045955	12.8723	0.10639	0.50837	0.0038076	0.90625	2686	6	2670	8	2650	16	2
JAM002-4.2	2.5012	146	0.54	0.18232	0.00047978	12.6922	0.11016	0.49981	0.0038811	0.89471	2691	6	2657	8	2613	17	4

Additional Samples Redated… continued

Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
JAM002-4.5	1.1	144	0.52	0.18293	0.00042183	12.9939	0.11337	0.51153	0.004072	0.91236	2691	6	2679	8	2663	17	1
JAM002-4.3	1.1146	152	0.56	0.18345	0.0004616	13.02	0.10067	0.51005	0.0035114	0.89037	2699	6	2681	7	2657	15	2
JAM002-11.1	0.344	63	0.16	0.17713	0.0012192	12.0021	0.1618	0.49379	0.0053798	0.80818	2618	13	2605	13	2587	23	1
JAM002-11.4	6.9856	133	0.35	0.15752	0.0005621	8.7744	0.065938	0.40199	0.0024913	0.8247	2438	7	2315	7	2178	11	13
JAM002-11.3	3.6438	143	0.27	0.17119	0.00048863	10.7891	0.08384	0.45521	0.0031408	0.88788	2576	6	2505	7	2418	14	7
JAM002-11.2	1.4187	98	0.31	0.18004	0.00042602	12.2325	0.084993	0.49115	0.0030163	0.88387	2659	5	2622	7	2576	13	4
JAM009-49.1	0.66726	486	0.25	0.18285	0.00087501	13.1449	0.16379	0.51797	0.0051669	0.80056	2690	12	2690	12	2691	22	0
JAM009-49.6	5.7732	576	0.32	0.17864	0.00033044	12.1862	0.11749	0.49323	0.0044563	0.93709	2645	6	2619	9	2585	19	3
JAM009-49.5	3.2512	368	0.48	0.18436	0.00052556	12.7807	0.10934	0.5009	0.0038501	0.89843	2699	6	2664	8	2618	17	4
JAM009-49.4	4.3732	288	0.61	0.19398	0.00048939	13.6397	0.11838	0.50767	0.0040532	0.91994	2784	6	2725	8	2647	17	6
JAM009-49.7	9.8972	370	1.14	0.20154	0.00075491	12.7128	0.13262	0.45608	0.0042657	0.89655	2844	8	2659	10	2422	19	18
JAM009-49.8	6.0082	304	0.79	0.20143	0.00053975	13.5851	0.13373	0.4873	0.0044822	0.93442	2844	6	2721	9	2559	19	12
JAM009-49.3	12.3867	318	1.63	0.2187	0.00088784	14.2487	0.12359	0.47006	0.0034276	0.84064	2980	8	2766	8	2484	15	20
JAM009-49.2	10.2886	332	1.4	0.22254	0.00065022	14.6985	0.17706	0.47624	0.0054198	0.94475	3009	6	2796	11	2511	24	20
JAM009-51.1	0.34917	350	0.43	0.18872	0.0010134	13.5988	0.16216	0.51811	0.0049694	0.80436	2745	12	2722	11	2691	21	2
JAM009-51.6	3.5996	1182	0.33	0.18317	0.00039359	12.8688	0.13075	0.50635	0.0048334	0.93951	2692	6	2670	10	2641	21	2
JAM009-51.7	12.9116	1024	0.28	0.18565	0.00050496	13.9291	0.11158	0.54063	0.0037708	0.8707	2715	6	2745	8	2786	16	-3
JAM009-51.3	3.9307	461	2.25	0.19064	0.00044197	13.1882	0.09857	0.49913	0.0033656	0.90218	2756	5	2693	7	2610	14	6
JAM009-51.2	3.9898	421	1.88	0.19388	0.00064655	13.3307	0.10388	0.49643	0.0033397	0.86333	2783	6	2703	7	2598	14	8
JAM009-51.5	6.6071	567	1.67	0.19487	0.0010866	13.42	0.1509	0.49644	0.004601	0.82423	2794	10	2710	11	2598	20	8
JAM009-51.4	8.3107	775	1.61	0.20511	0.00049646	13.5655	0.17703	0.47688	0.0058495	0.93992	2877	7	2720	12	2514	26	15
JAM009-54.1	0.19757	143	0.83	0.17938	0.00086979	13.0503	0.1556	0.52253	0.0051605	0.82832	2663	11	2683	11	2710	22	-2
JAM009-54.2	1.0201	237	1.36	0.17915	0.00040791	12.7136	0.10144	0.51046	0.0036886	0.90565	2659	6	2659	8	2659	16	0
JAM009-54.6	2.3058	419	1.41	0.18025	0.00040145	12.5952	0.10209	0.5027	0.0037063	0.90963	2669	6	2650	8	2625	16	2
JAM009-54.7	2.7433	371	1.11	0.18423	0.00038957	12.3681	0.096199	0.48376	0.0034104	0.90639	2702	5	2633	7	2544	15	7
JAM009-54.5	2.1877	336	1.6	0.19001	0.00038045	12.8586	0.10828	0.4856	0.0037343	0.91325	2760	6	2669	8	2552	16	9
JAM009-54.4	2.4508	330	1.29	0.19351	0.00051777	13.629	0.12537	0.50578	0.0042744	0.91874	2788	6	2724	9	2639	18	7
JAM009-54.3	3.4279	260	1.68	0.20618	0.00048955	13.3057	0.10331	0.46382	0.0032503	0.90257	2890	5	2702	7	2456	14	18
JAM09-D22.1	0.21922	633	1.62	0.1779	0.0010809	13.1843	0.19207	0.5287	0.0059627	0.77415	2661	15	2693	14	2736	25	-3
JAM09-D22.2	0.72923	699	0.99	0.17717	0.00036091	12.4704	0.092068	0.50806	0.0033197	0.88504	2635	6	2641	7	2648	14	-1
JAM09-D22.5	0.6033	539	0.87	0.17703	0.00034188	12.6283	0.086717	0.51465	0.0031658	0.89578	2634	5	2652	6	2676	13	-2
JAM09-D22.6	1.9515	726	1.01	0.17712	0.00037935	12.2171	0.10297	0.49704	0.0038939	0.92952	2637	5	2621	8	2601	17	2
JAM09-D22.4	1.7667	706	1	0.18146	0.00041133	12.5268	0.095777	0.49871	0.003382	0.88697	2673	6	2645	7	2608	15	3
JAM09-D22.3	8.1488	587	1.15	0.20285	0.00089664	13.7372	0.1261	0.48963	0.0036095	0.8031	2854	9	2732	9	2569	16	12
JAM09-D24.1	0.15509	414	1.4	0.17909	0.00081148	13.3904	0.18589	0.53135	0.0055682	0.75488	2678	15	2708	13	2747	23	-3
JAM09-D24.6	0.332	934	0.96	0.17722	0.00032337	12.8871	0.11881	0.52197	0.0043136	0.89636	2644	7	2671	9	2708	18	-3
JAM09-D24.5	0.39991	641	0.93	0.17903	0.00034401	13.0236	0.10404	0.52231	0.0037239	0.89245	2661	6	2681	8	2709	16	-2
JAM09-D24.2	3.5358	717	1.06	0.17984	0.00042351	12.718	0.11868	0.5086	0.0044163	0.93049	2665	6	2659	9	2651	19	1
JAM09-D24.4	2.4384	831	1.17	0.18289	0.00037961	12.8716	0.11158	0.50547	0.0040482	0.92388	2695	5	2670	8	2637	17	3

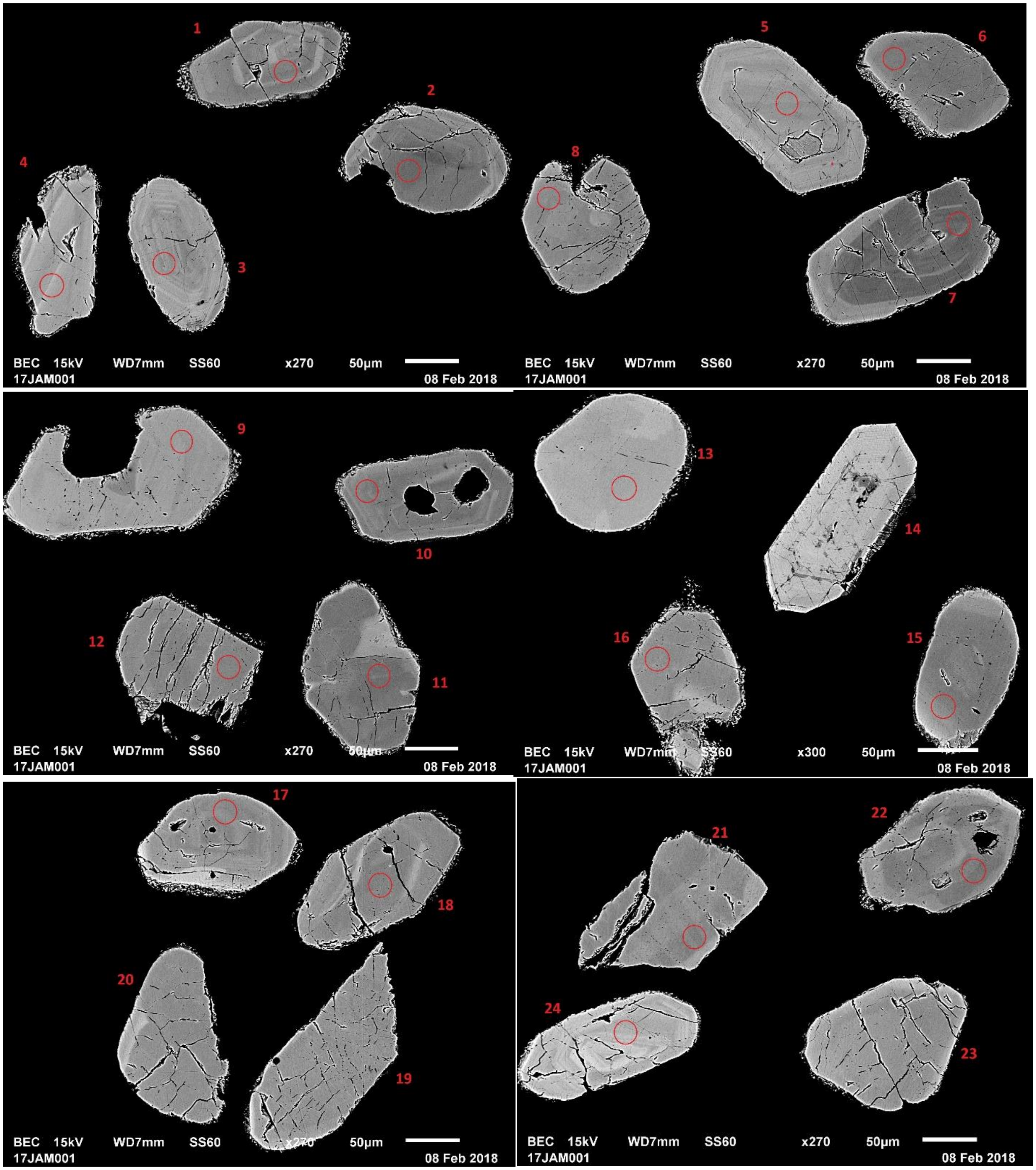
Additional Samples Redated… continued

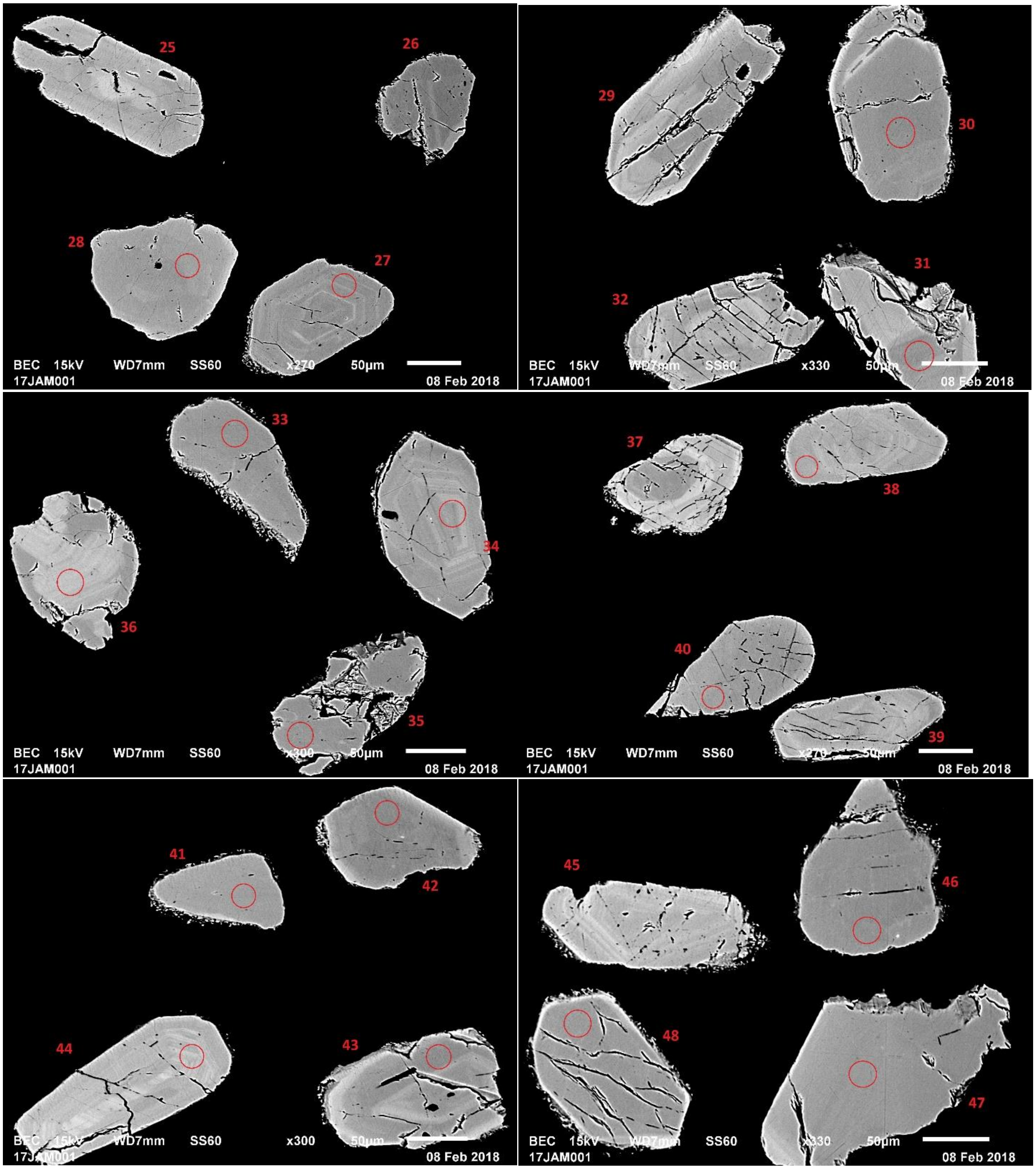
Sample	Element Counts			Raw Ratios		Standardized Concordia					Ages Ma						
Analysis	88Sr (Kcps)	U (ppm)	Th/U (ppm)	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	RhoXY	207Pb/ 206Pb	Sig1	207Pb/ 235U	Sig1	206Pb/ 238U	Sig1	%Disc
JAM09-D24.3	1.837	501	0.86	0.18656	0.00038503	13.0134	0.10463	0.5011	0.0037098	0.9208	2728	5	2681	8	2619	16	5

11. Appendix B

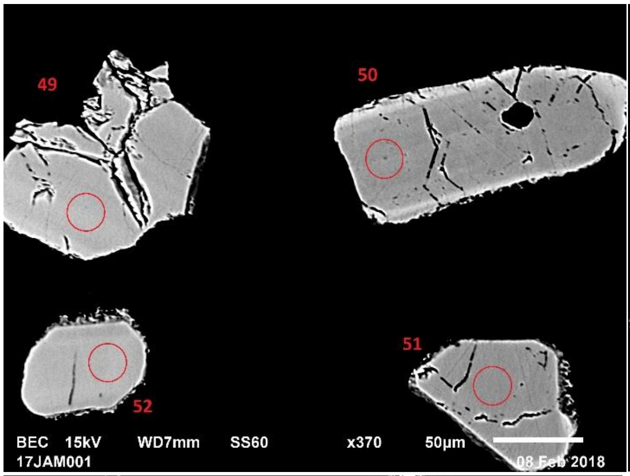
U-Pb Zircon Images

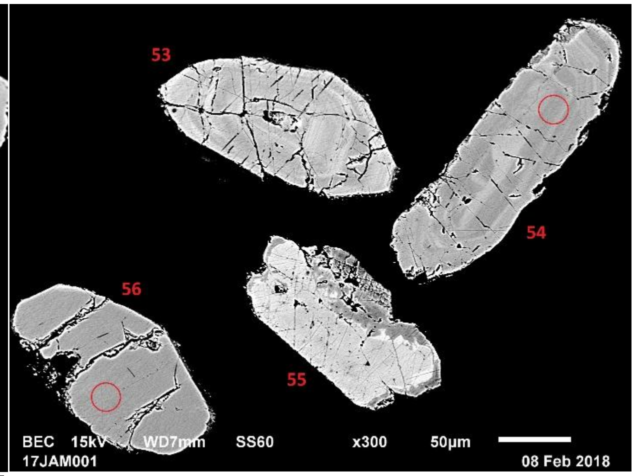
M180123 - 17JAM001

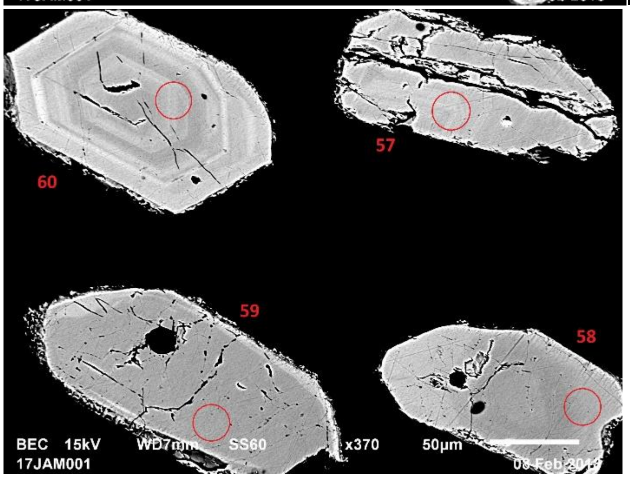




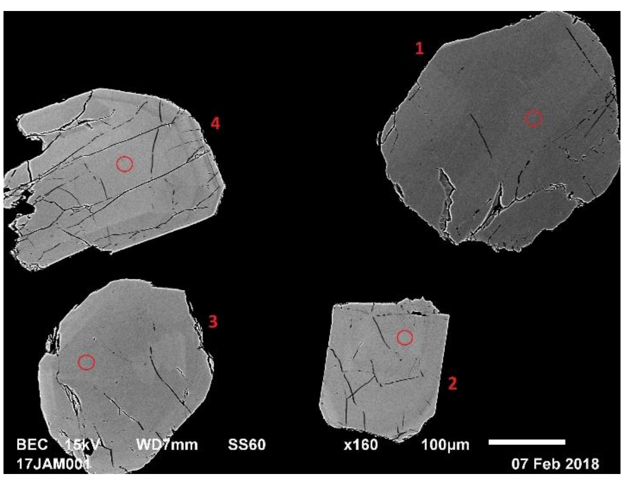
25
26
28
27
BEC 15kV WD7mm SS60 x270 50µm
17JAM001
08 Feb 2018
29
30
32
31
BEC 15kV WD7mm SS60 x330 50µm
17JAM001
08 Feb 2018
33
34
36
35
BEC 15kV WD7mm SS60 x300 50µm
17JAM001
08 Feb 2018
37
38
40
39
BEC 15kV WD7mm SS60 x270 50µm
17JAM001
08 Feb 2018
41
42
44
43
BEC 15kV WD7mm SS60 x300 50µm
17JAM001
08 Feb 2018
45
46
48
47
BEC 15kV WD7mm SS60 x330 50µm
17JAM001
08 Feb 2018

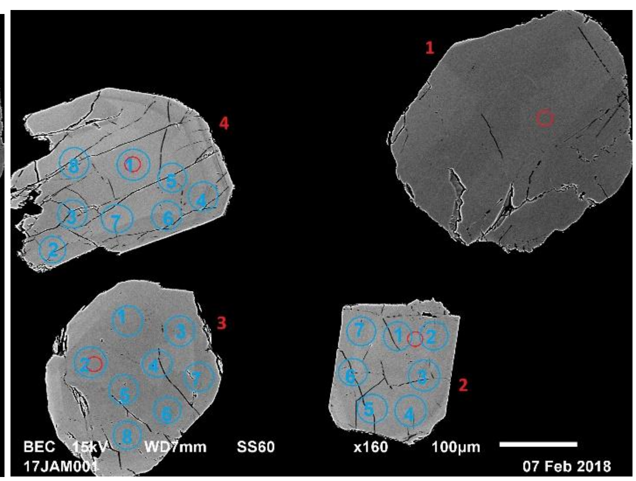


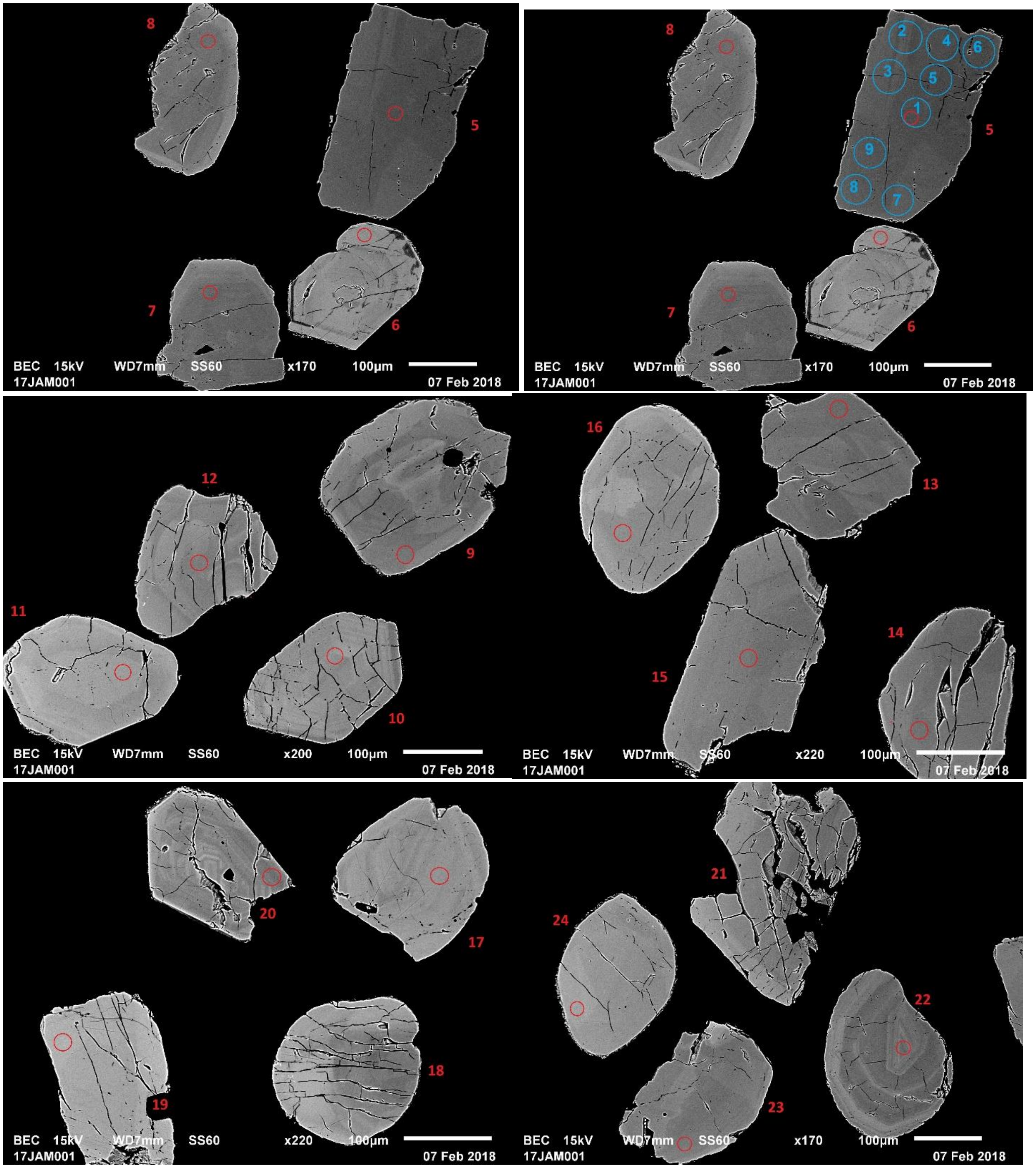


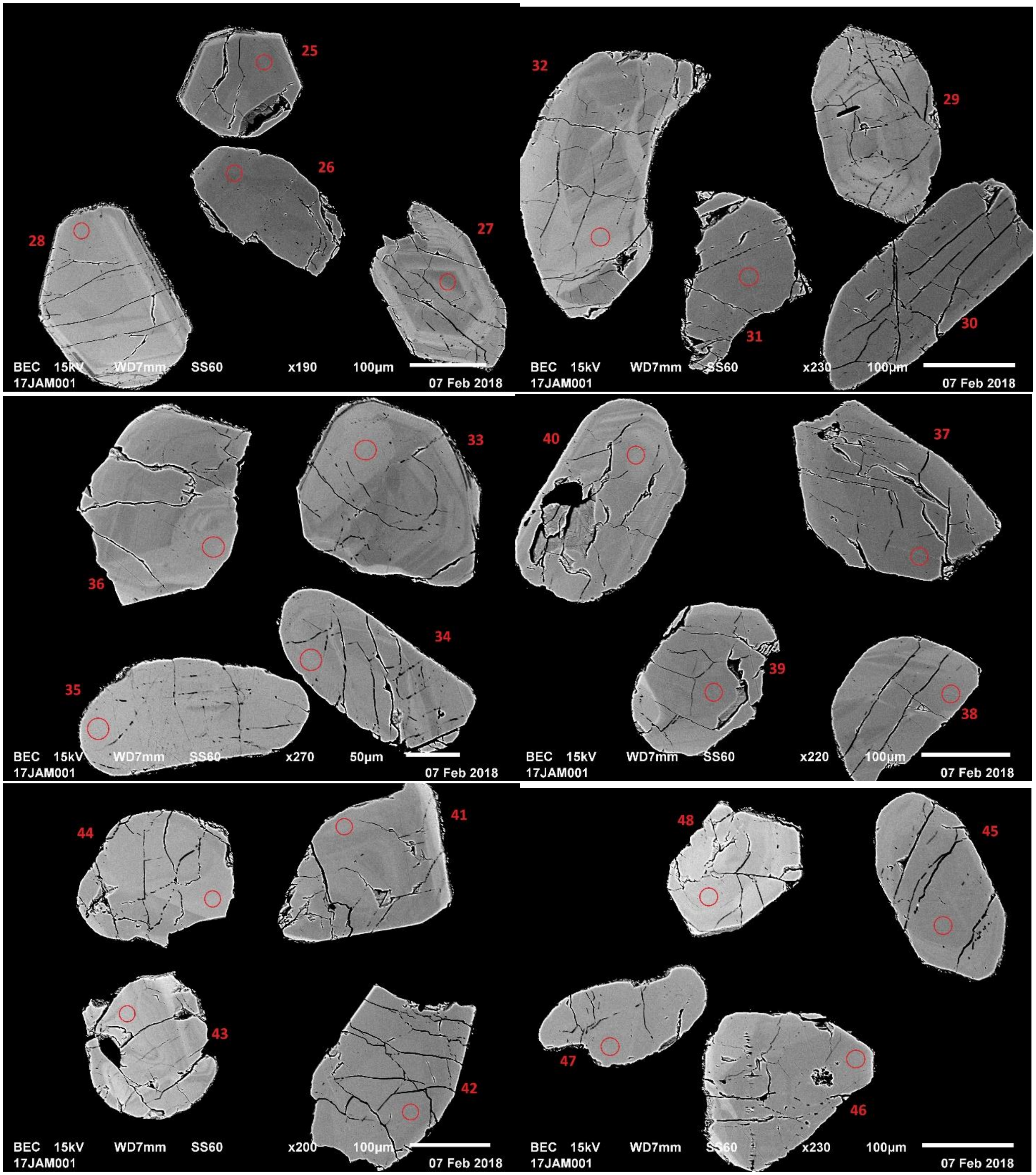


M180129A - 17JAM001

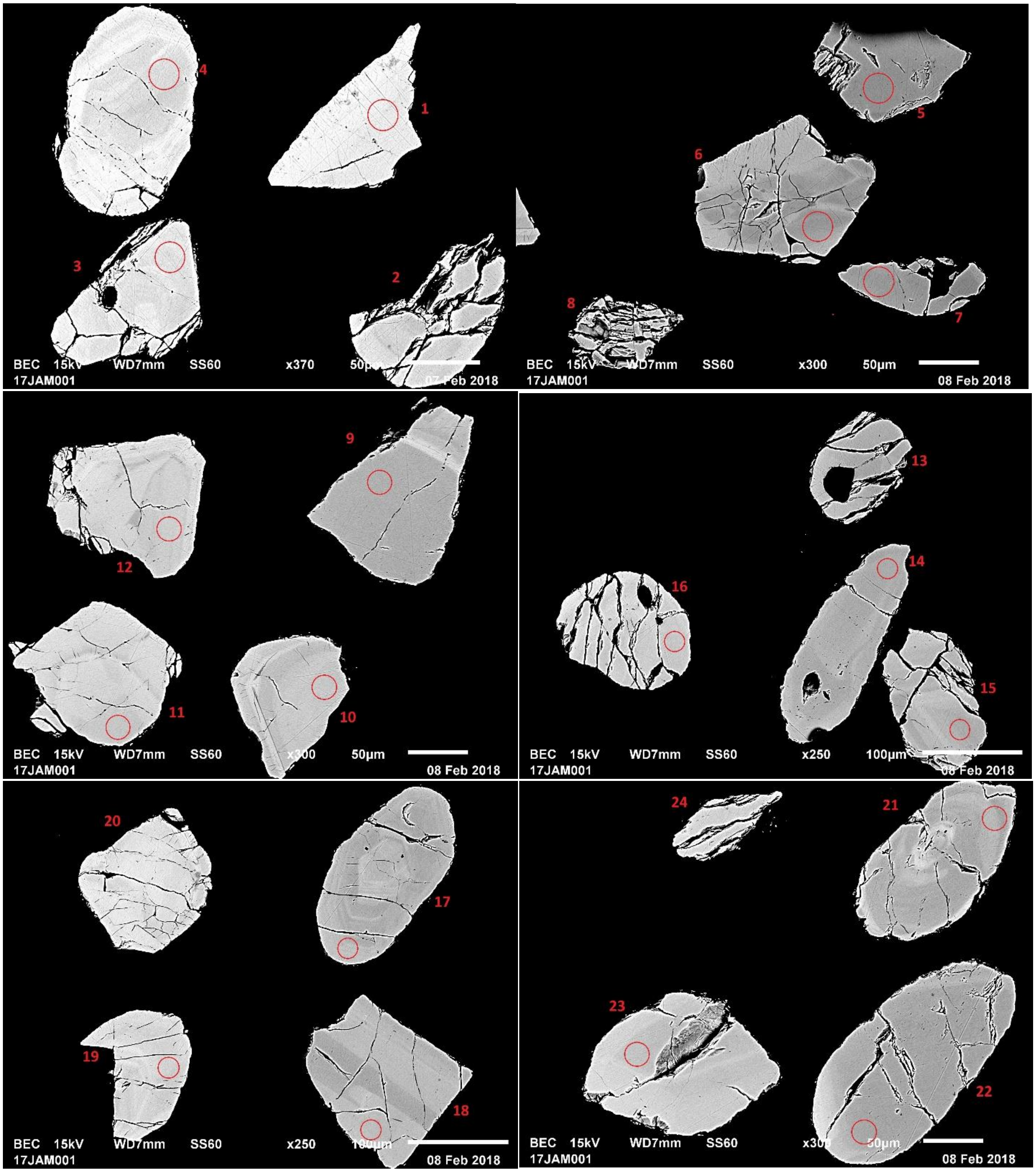


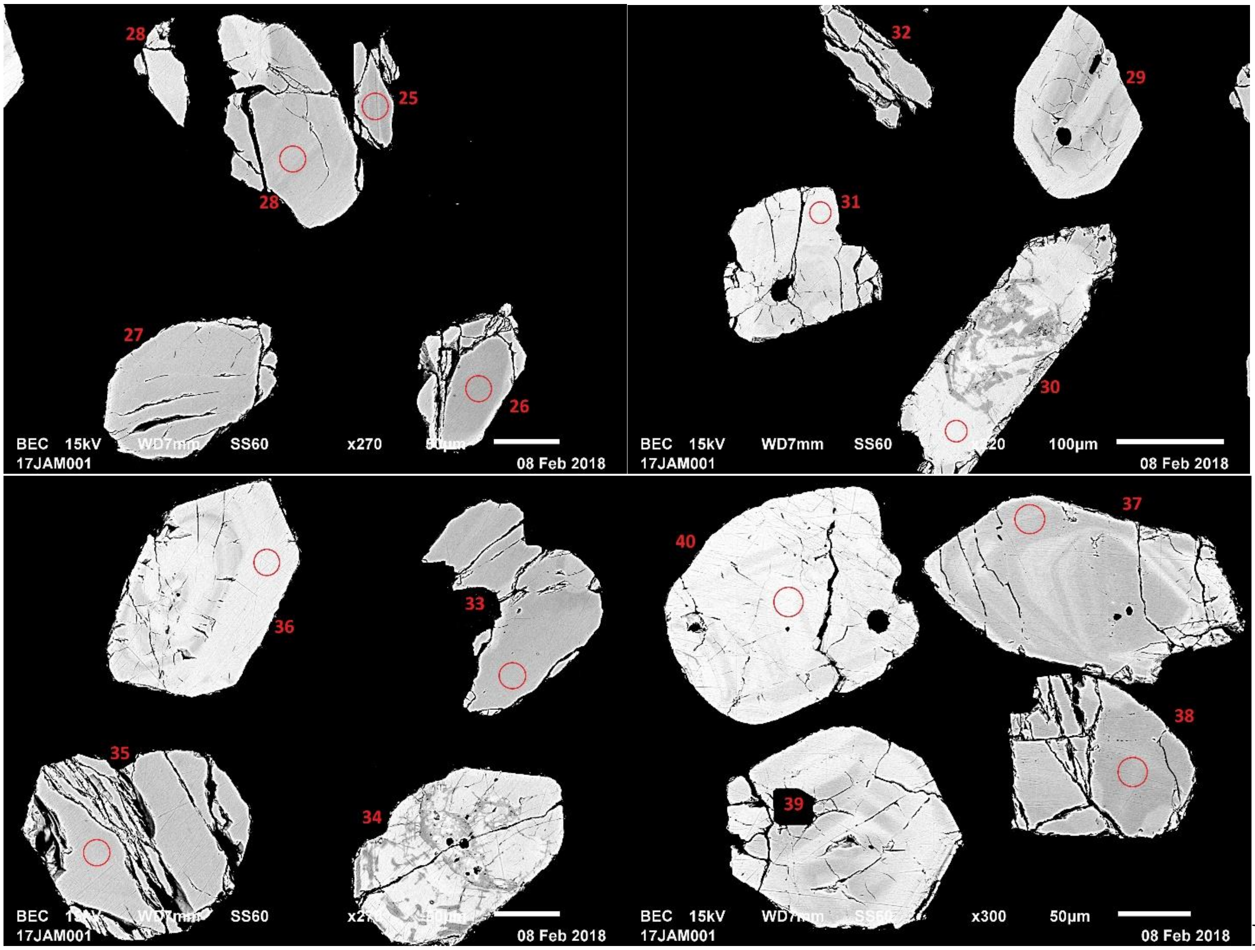



BEC 15kV WD7mm SS60 x170 100µm
17JAM001 07 Feb 2018
BEC 15kV WD7mm SS60 x170 100µm
17JAM001 07 Feb 2018
BEC 15kV WD7mm SS60 x200 100µm
17JAM001 07 Feb 2018
BEC 15kV WD7mm SS60 x220 100µm
17JAM001 07 Feb 2018
BEC 15kV WD7mm SS60 x220 100µm
17JAM001 07 Feb 2018
BEC 15kV WD7mm SS60 x170 100µm
17JAM001 07 Feb 2018

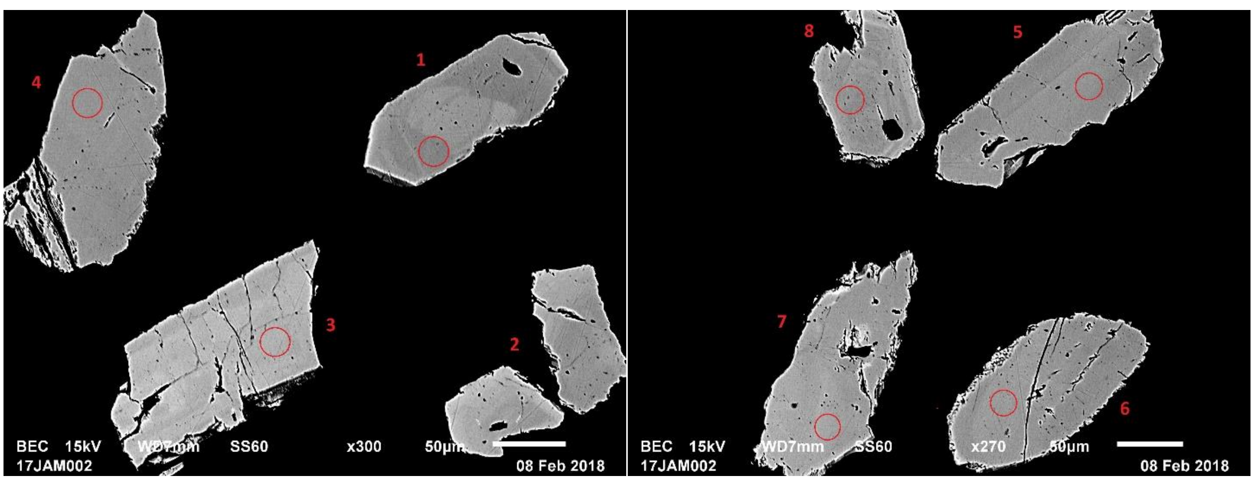


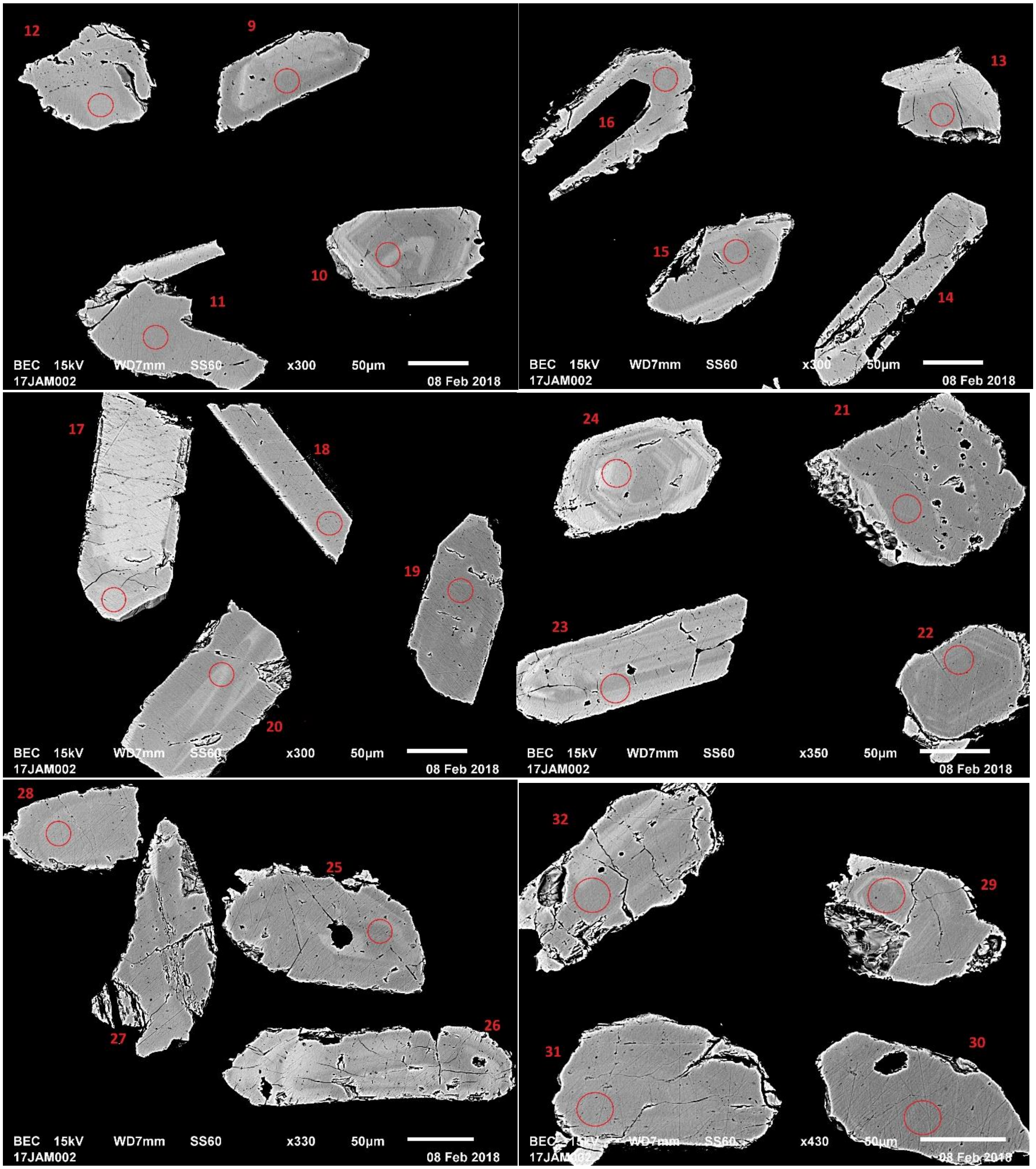
M180129B - 17JAM001

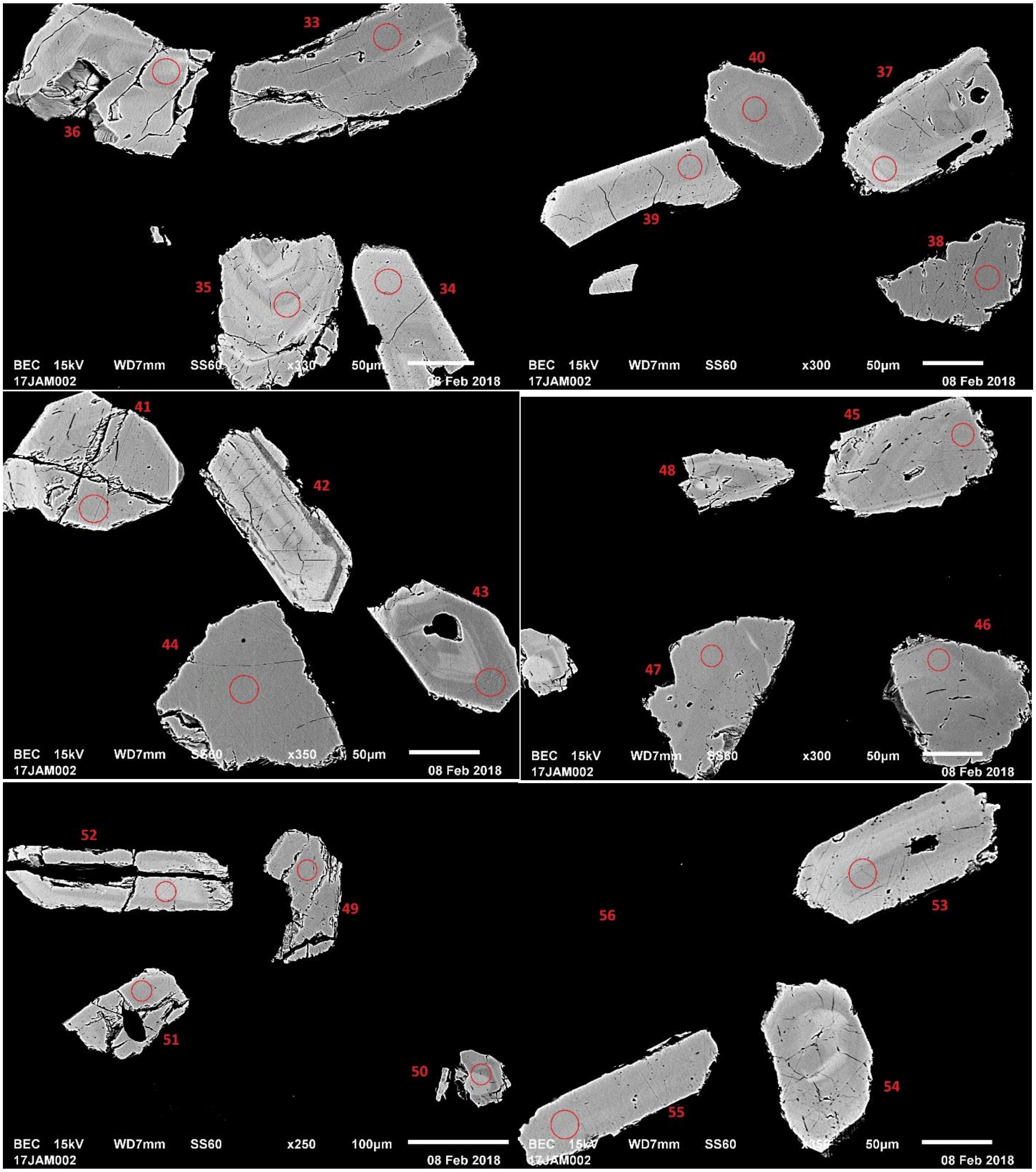

4
1
3
2
BEC 15kV WD7mm SS60 x370 50µ
17JAM001 07 Feb 2018
5
6
8
7
BEC 15kV WD7mm SS60 x300 50µm
17JAM001 08 Feb 2018
9
12
11
10
BEC 15kV WD7mm SS60 50µm
17JAM001 08 Feb 2018
13
14
16
15
BEC 15kV WD7mm SS60 x250 100µm
17JAM001 08 Feb 2018
20
17
19
18
BEC 15kV WD7mm SS60 x250
17JAM001 08 Feb 2018
24
21
23
22
BEC 15kV WD7mm SS60 x30 50µm
17JAM001 08 Feb 2018

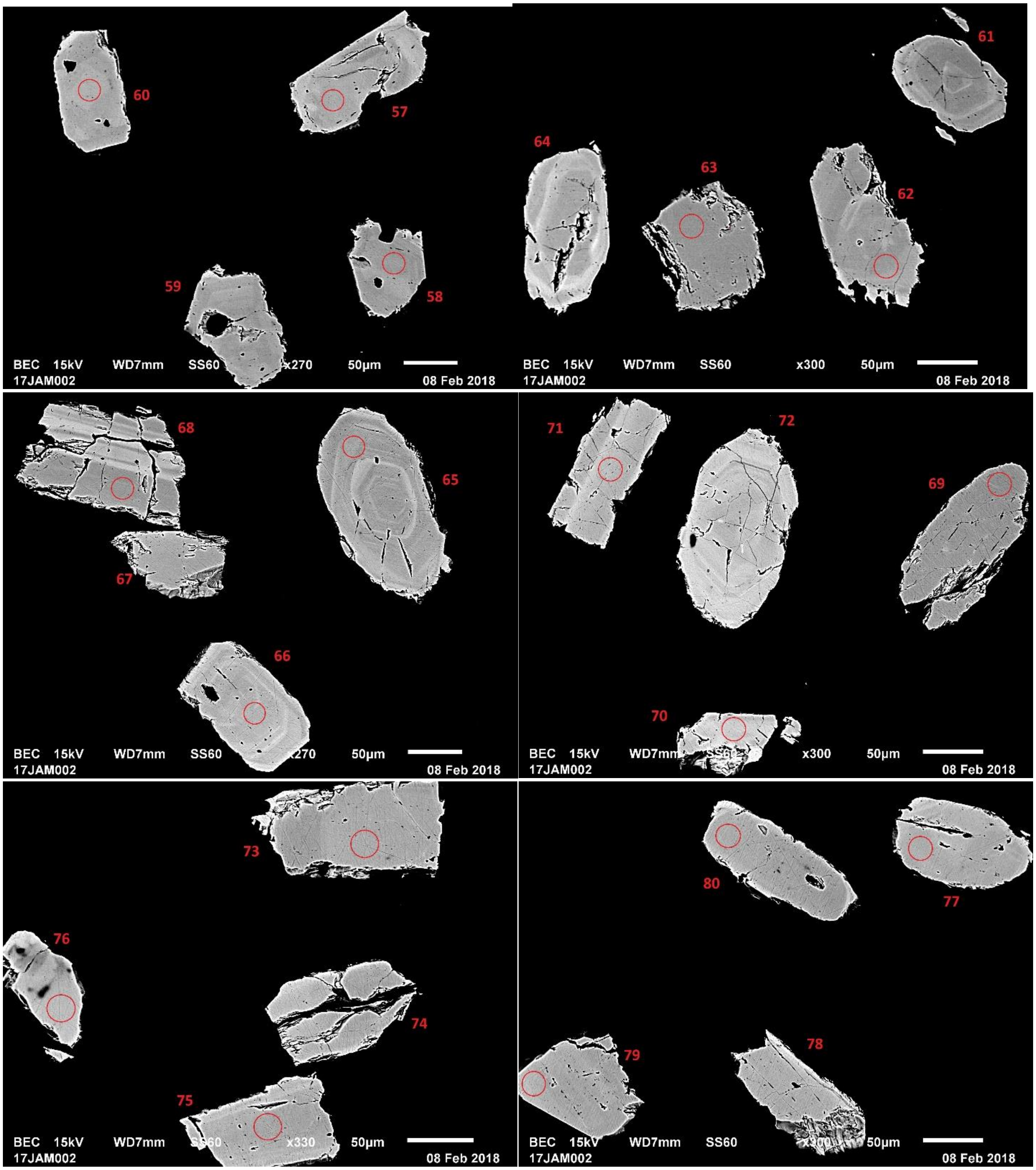


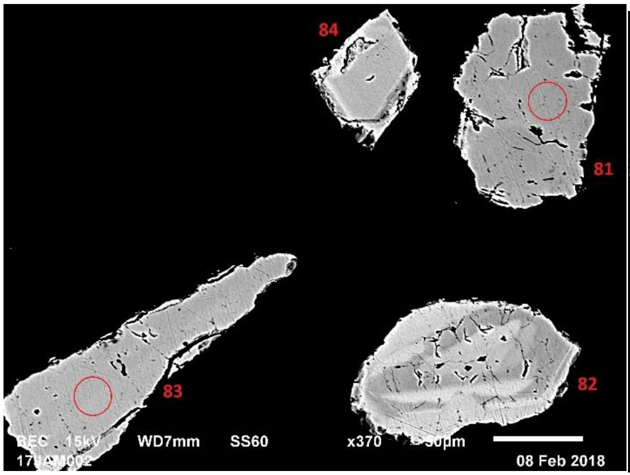
M180123 - 17JAM002

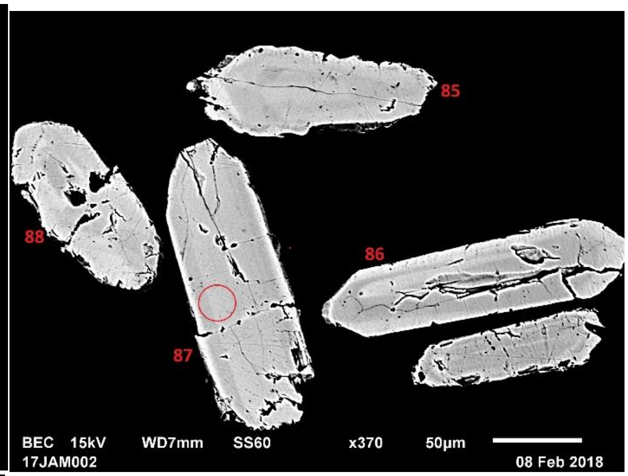


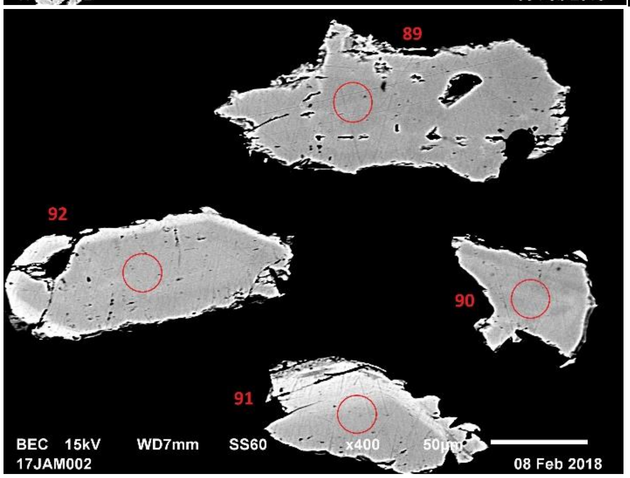

12
9
16
13
15
10
14
11
BEC 15kV WD7mm SS60 x300 50µm
17JAM002 08 Feb 2018
BEC 15kV WD7mm SS60 x300 50µm
17JAM002 08 Feb 2018
17
18
24
21
19
23
22
20
BEC 15kV WD7mm SS60 x300 50µm
17JAM002 08 Feb 2018
BEC 15kV WD7mm SS60 x350 50µm
17JAM002 08 Feb 2018
28
32
25
29
27
26
31
30
BEC 15kV WD7mm SS60 x330 50µm
17JAM002 08 Feb 2018
x430 50µm


33
36
40
37
39
38
35
34
BEC 15kV WD7mm SS60 x330 50µm
17JAM002 08 Feb 2018
BEC 15kV WD7mm SS60 x300 50µm
17JAM002 08 Feb 2018
41
42
43
44
45
48
46
47
BEC 15kV WD7mm SS60 x350 50µm
17JAM002 08 Feb 2018
BEC 15kV WD7mm SS60 x300 50µm
17JAM002 08 Feb 2018
52
49
56
53
51
50
55
54
BEC 15kV WD7mm SS60 x250 100µm
17JAM002 08 Feb 2018
BEC 15kV WD7mm SS60 50µm
17JAM002 08 Feb 2018

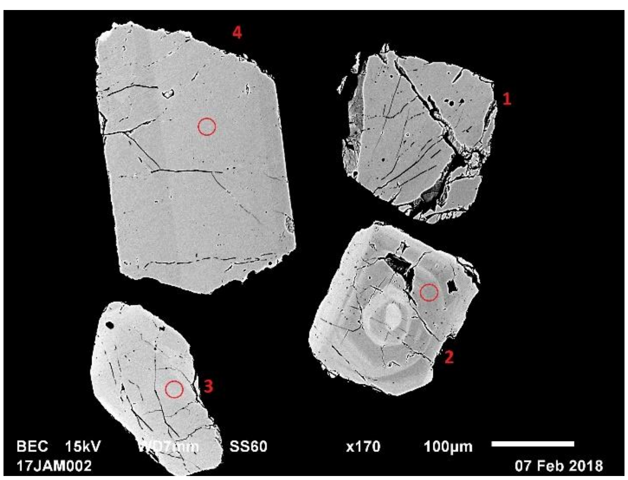

60
57
59
58
BEC 15kV WD7mm SS60 x270 50µm
17JAM002
08 Feb 2018
61
64
63
62
BEC 15kV WD7mm SS60 x300 50µm
17JAM002
08 Feb 2018
68
65
67
66
BEC 15kV WD7mm SS60 50µm
17JAM002
08 Feb 2018
71
72
69
70
BEC 15kV WD7mm x300 50µm
17JAM002
08 Feb 2018
73
76
74
75
BEC 15kV WD7mm x330 50µm
17JAM002
08 Feb 2018
80
77
79
78
BEC 15kV WD7mm SS60 50µm
17JAM002
08 Feb 2018

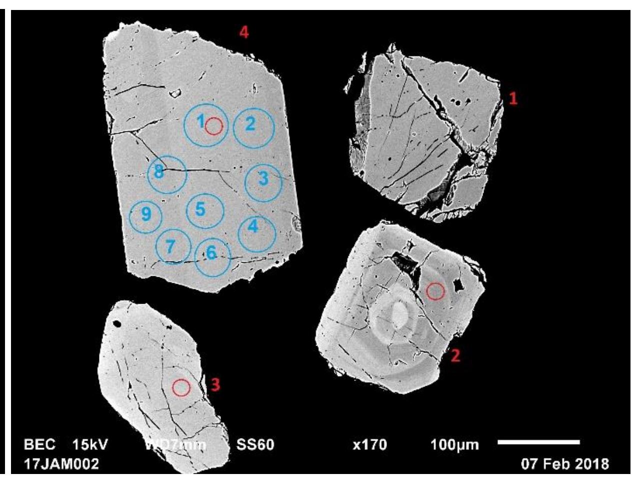


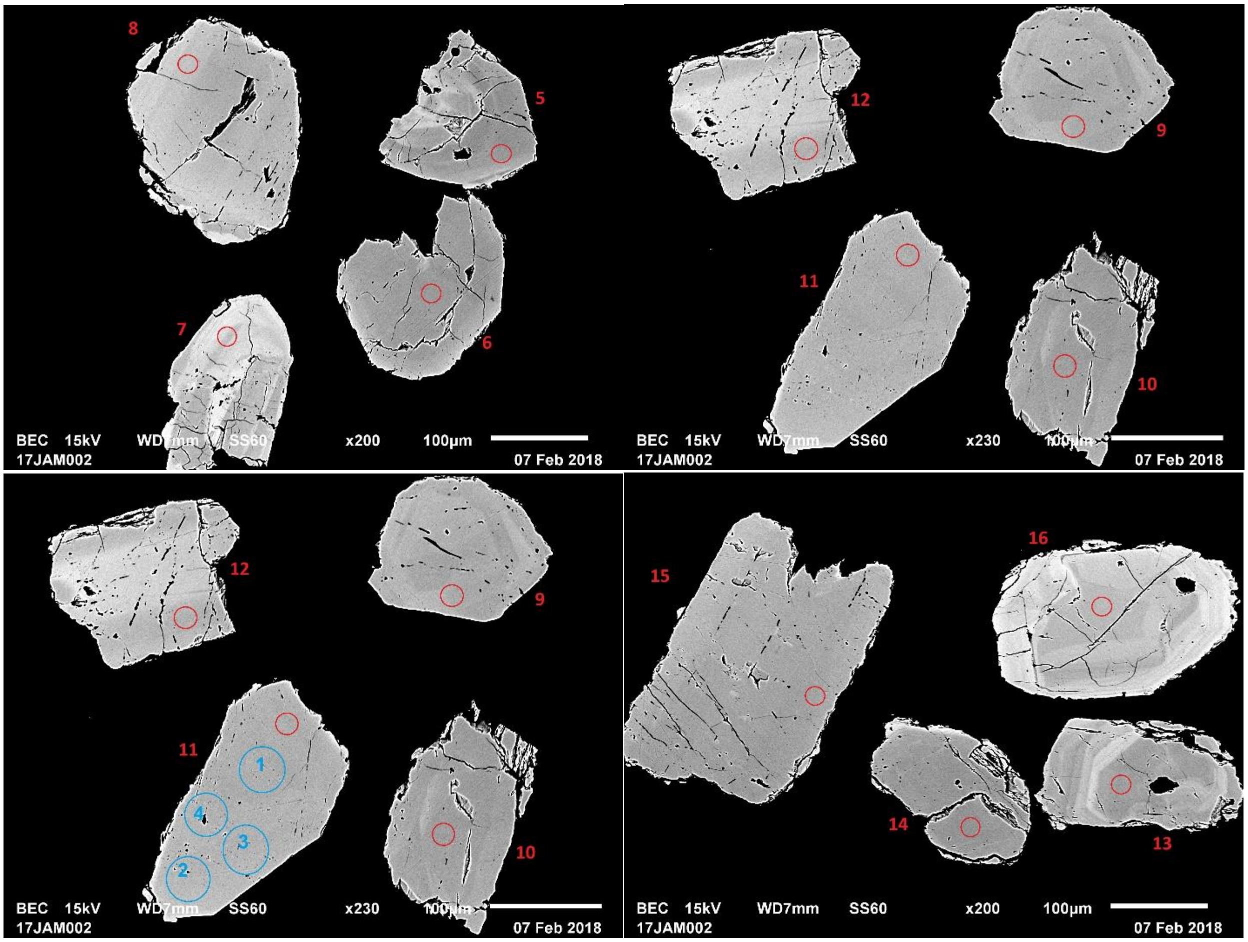




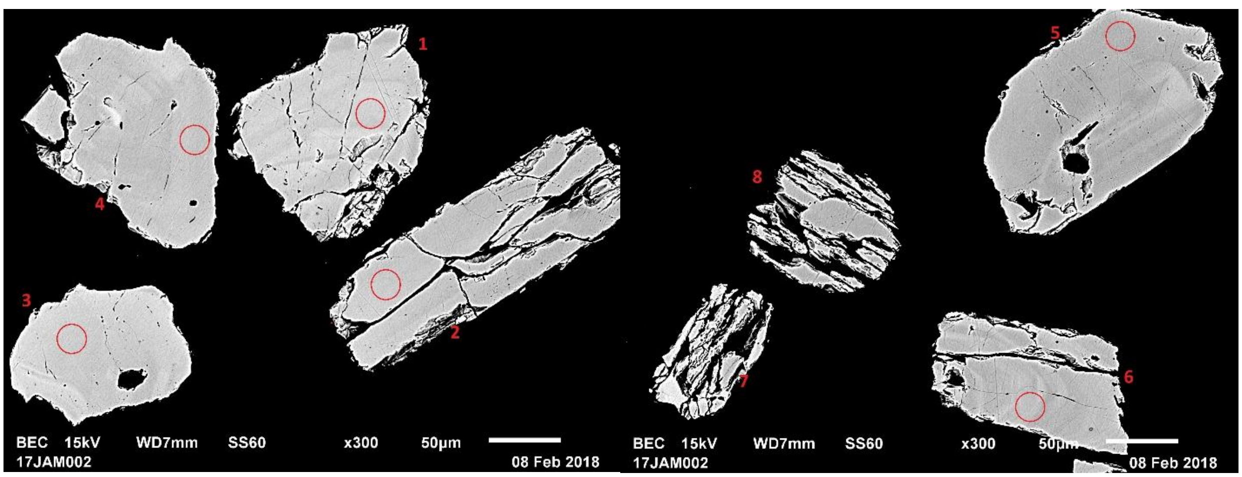
M180129A - 17JAM002

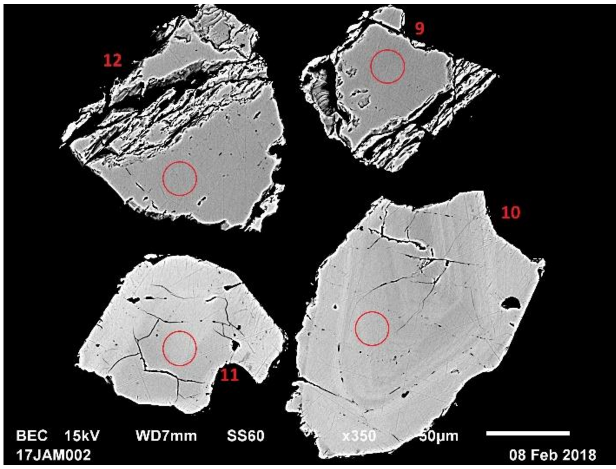


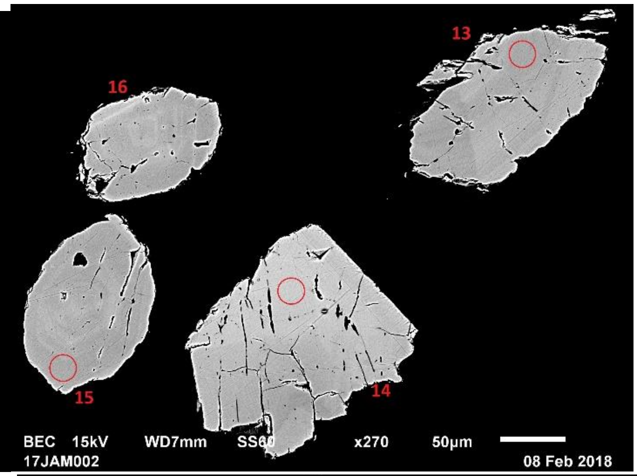


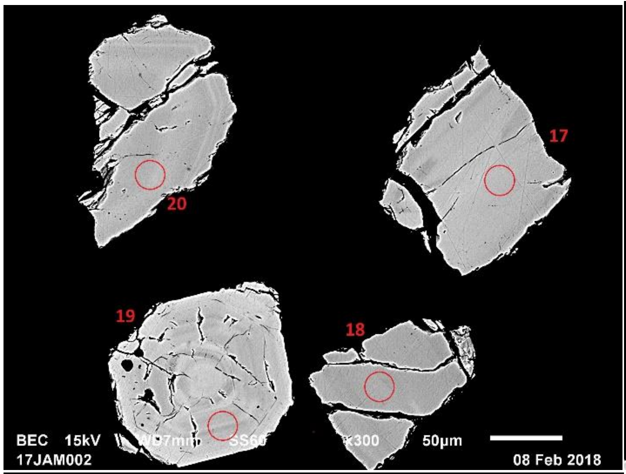


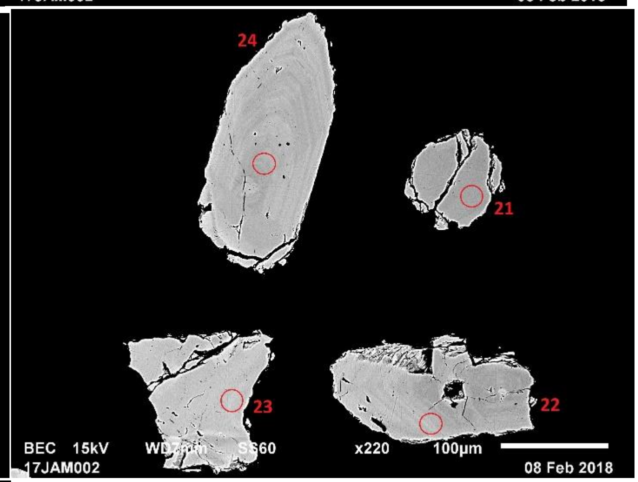
M180129B - 17JAM002

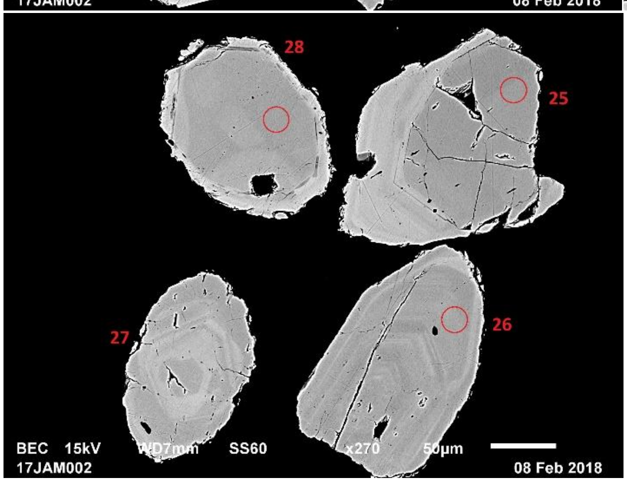




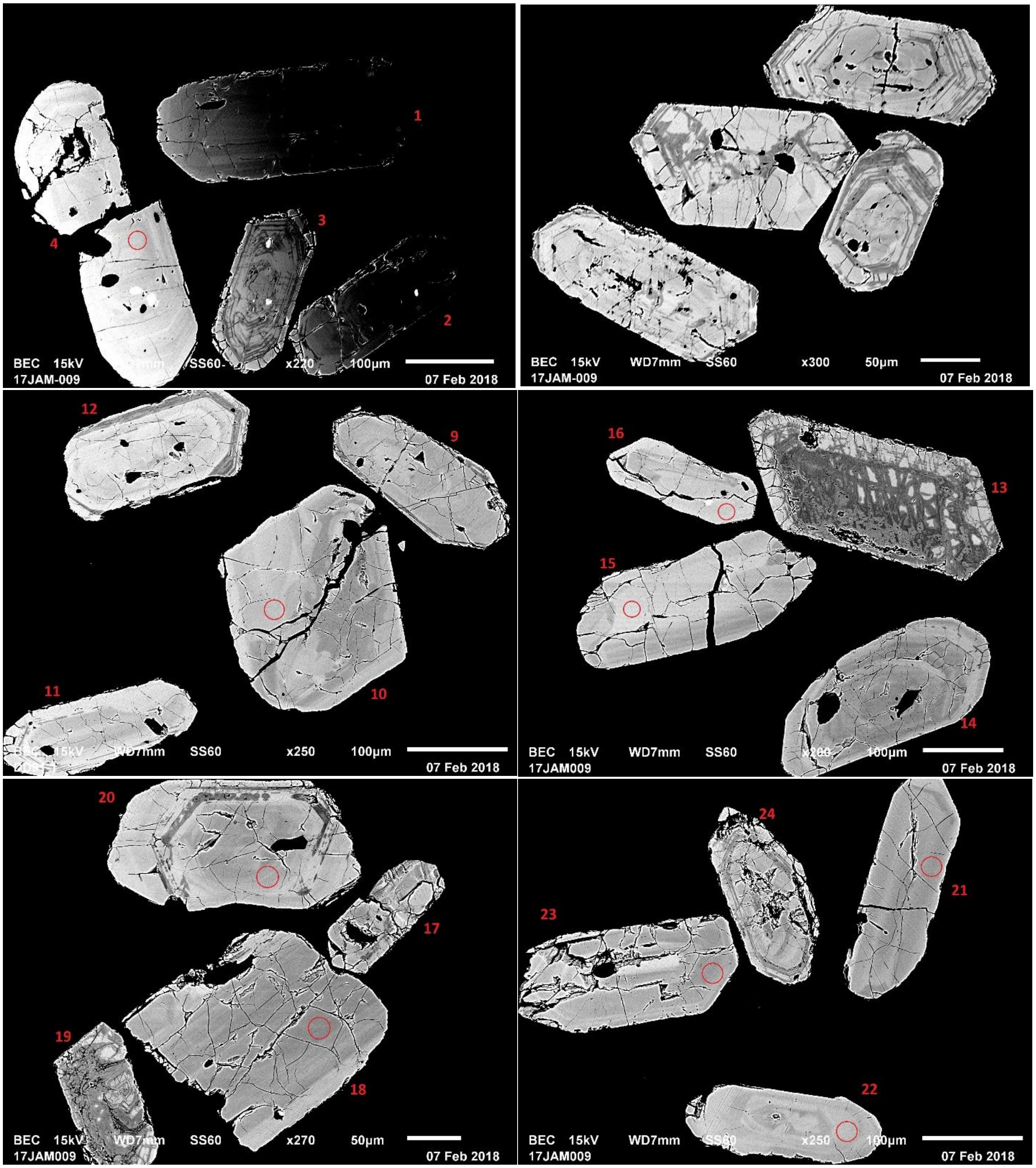


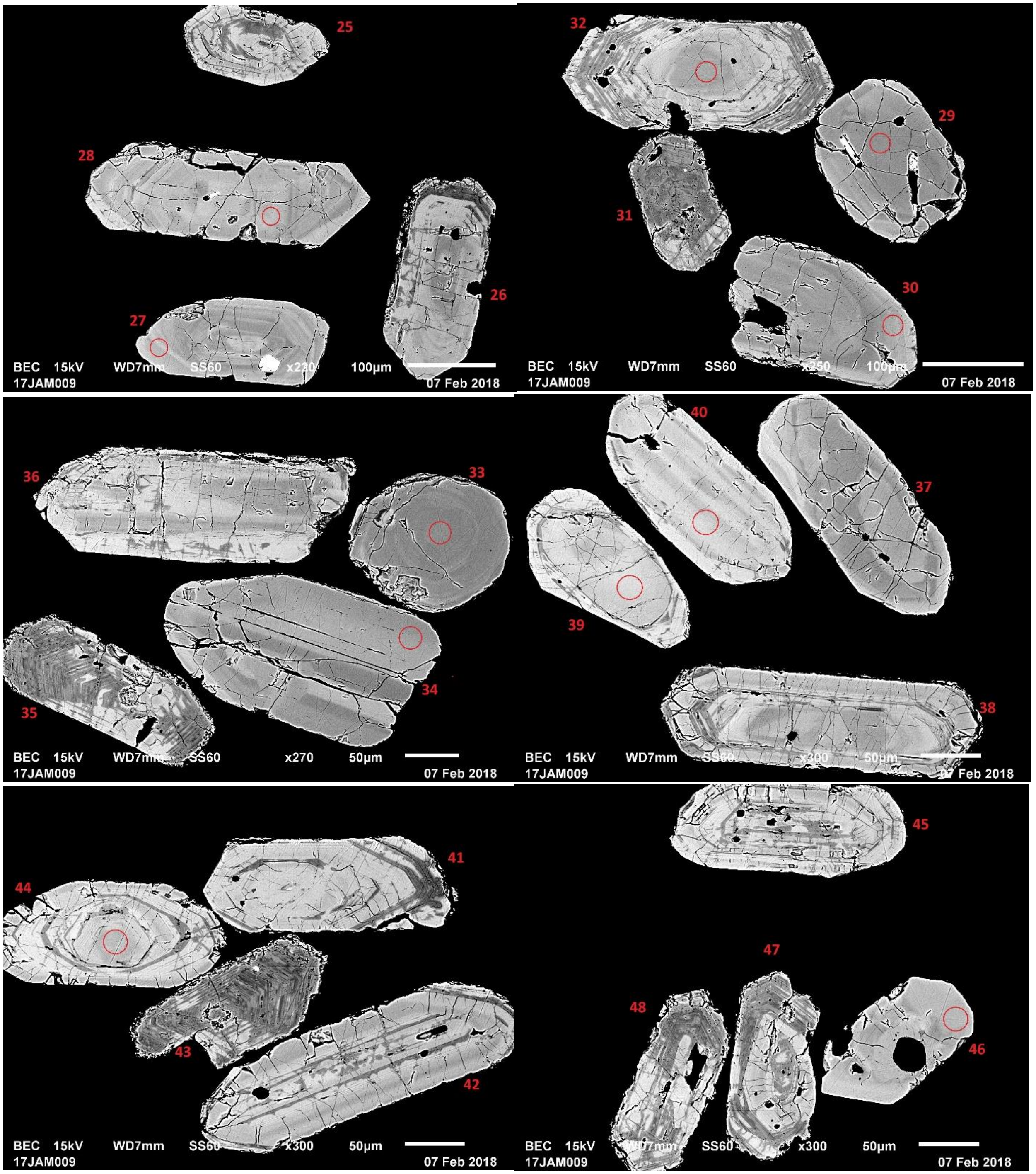


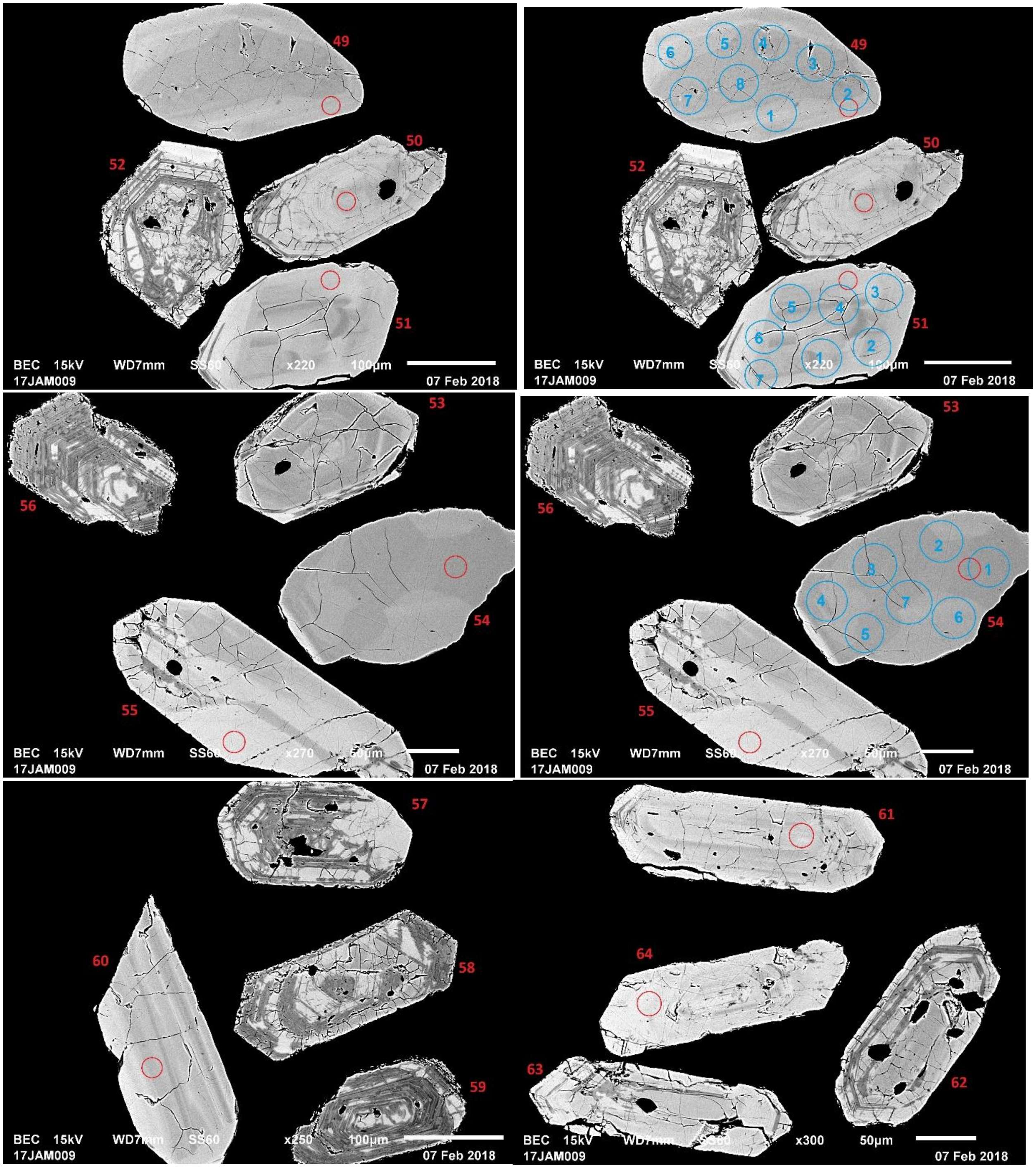


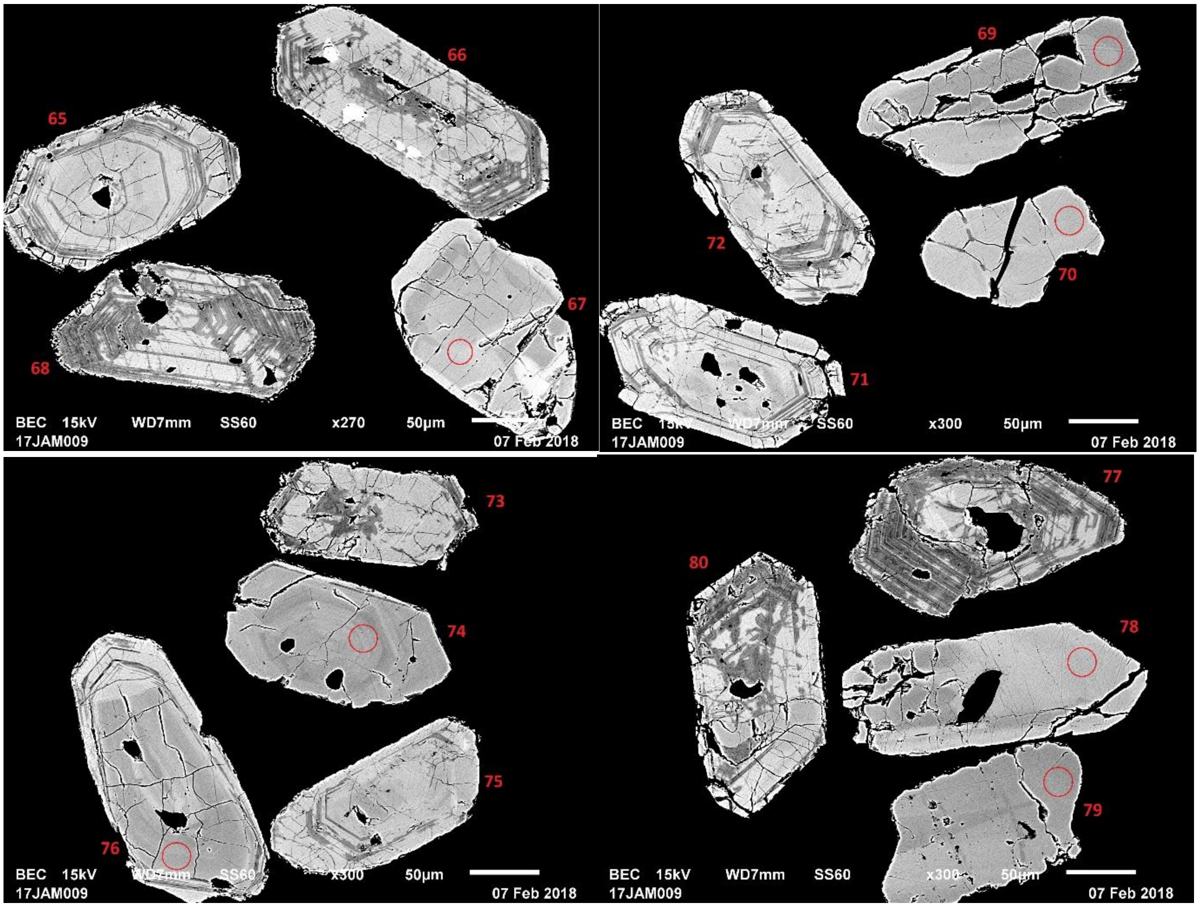


M180129A - 17JAM009

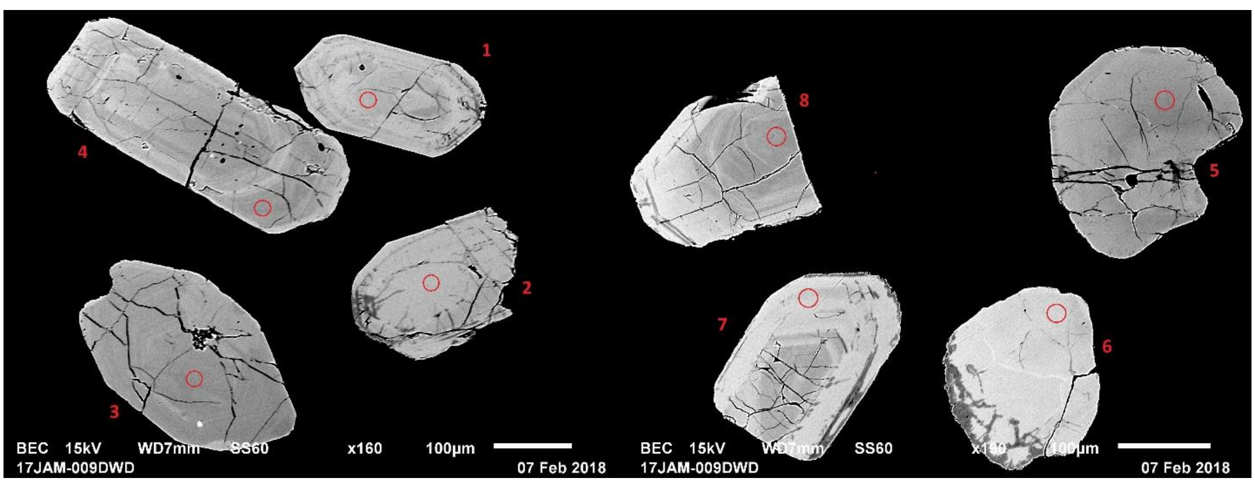

1
3
4
2
BEC 15kV SS60- x220 100µm
17JAM-009
07 Feb 2018
BEC 15kV WD7mm SS60 x300 50µm
17JAM-009
07 Feb 2018
12
9
10
11
WD7mm SS60 x250 100µm
07 Feb 2018
16
13
15
14
BEC 15kV WD7mm SS60
17JAM009
07 Feb 2018
20
17
19
18
BEC 15kV WD7mm SS60 x270 50µm
17JAM009
07 Feb 2018
24
21
23
22
BEC 15kV WD7mm x250
17JAM009
07 Feb 2018

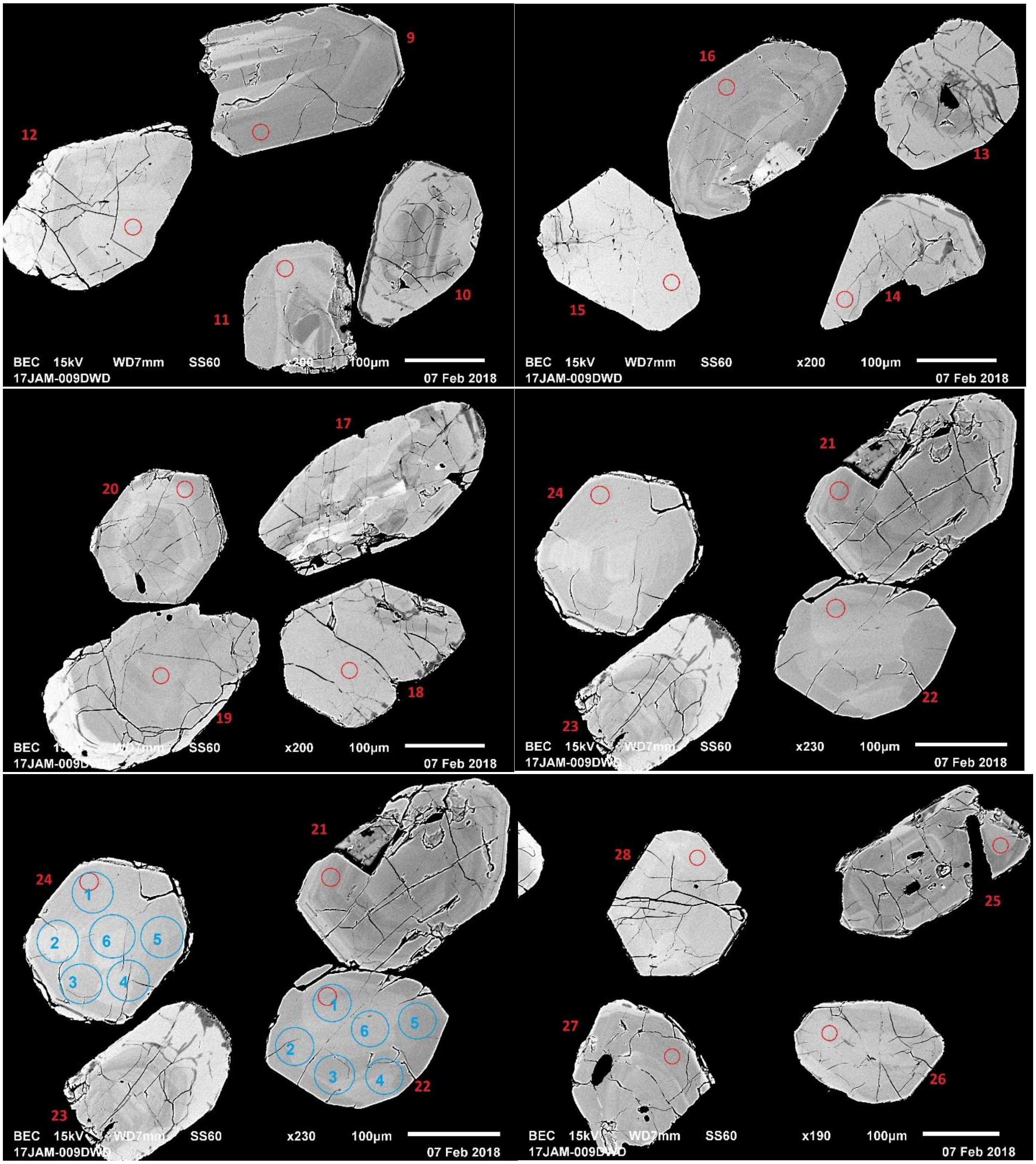

25
28
26
27
BEC 15kV WD7mm SS60 x220 100μm
17JAM009 07 Feb 2018
32
29
31
30
BEC 15kV WD7mm SS60 x250 100μm
17JAM009 07 Feb 2018
36
33
34
35
BEC 15kV WD7mm SS60 x270 50μm
17JAM009 07 Feb 2018
40
37
39
38
BEC 15kV WD7mm SS60 x300 50μm
17JAM009 07 Feb 2018
41
44
43
42
BEC 15kV WD7mm SS60 x300 50μm
17JAM009 07 Feb 2018
45
47
48
46
BEC 15kV WD7mm SS60 x300 50μm
17JAM009 07 Feb 2018

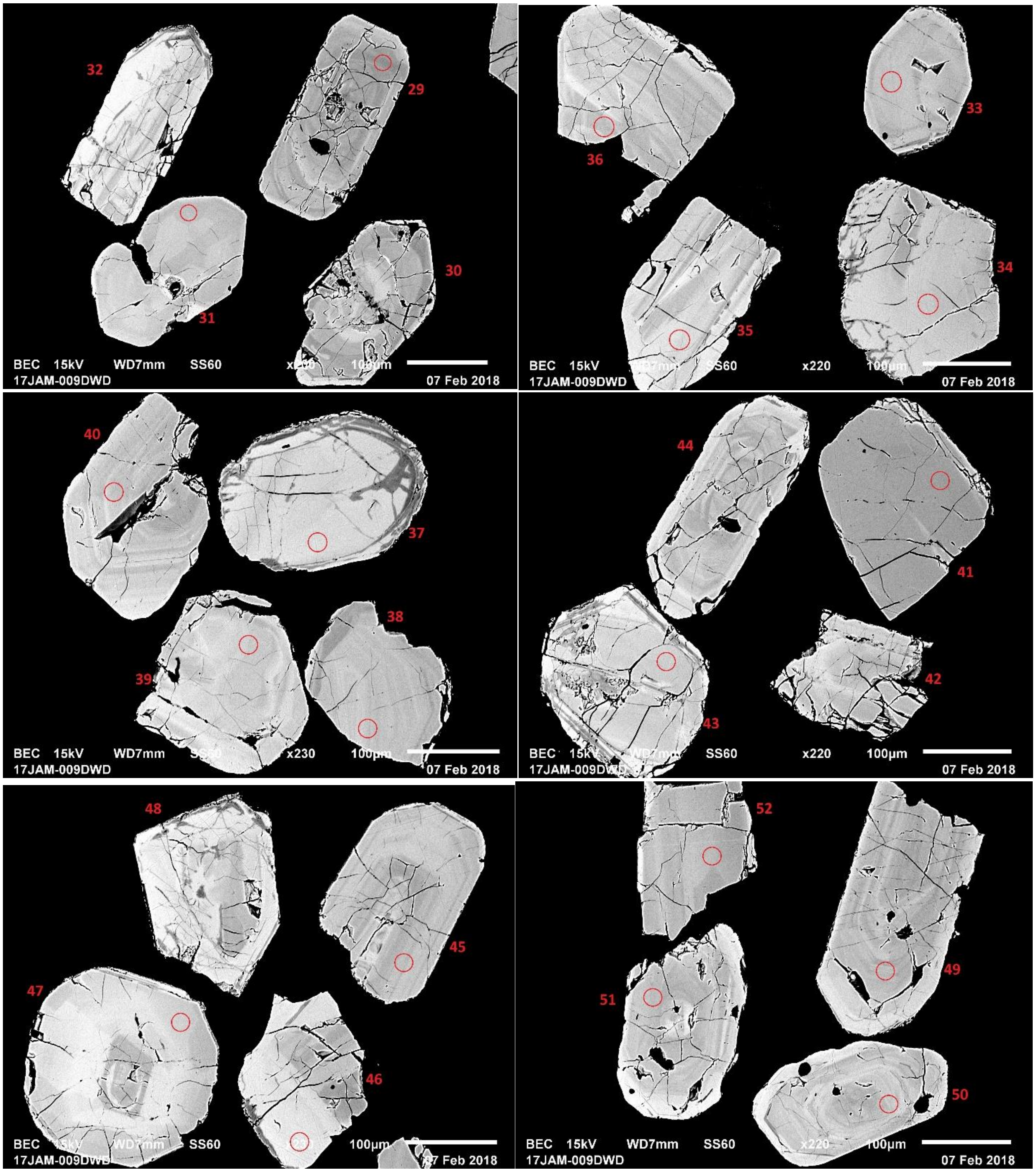

49
50
51
52
BEC 15kV WD7mm SS60 x220 100µm
17JAM009 07 Feb 2018
49
50
51
52
BEC 15kV WD7mm SS60 x220 100µm
17JAM009 07 Feb 2018
53
54
55
56
BEC 15kV WD7mm SS60 x270 50µm
17JAM009 07 Feb 2018
53
54
55
56
BEC 15kV WD7mm SS60 x270 50µm
17JAM009 07 Feb 2018
57
58
59
60
BEC 15kV WD7mm SS60 x250 100µm
17JAM009 07 Feb 2018
61
62
63
64
BEC 15kV WD7mm SS60 x300 50µm
17JAM009 07 Feb 2018

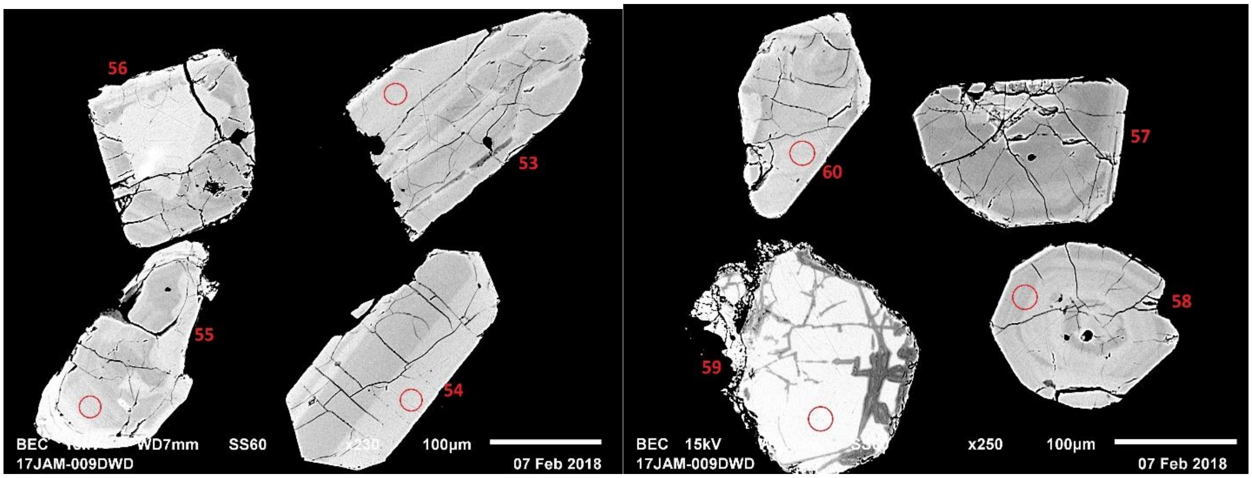


M180129A - 17JAM009 – DWD

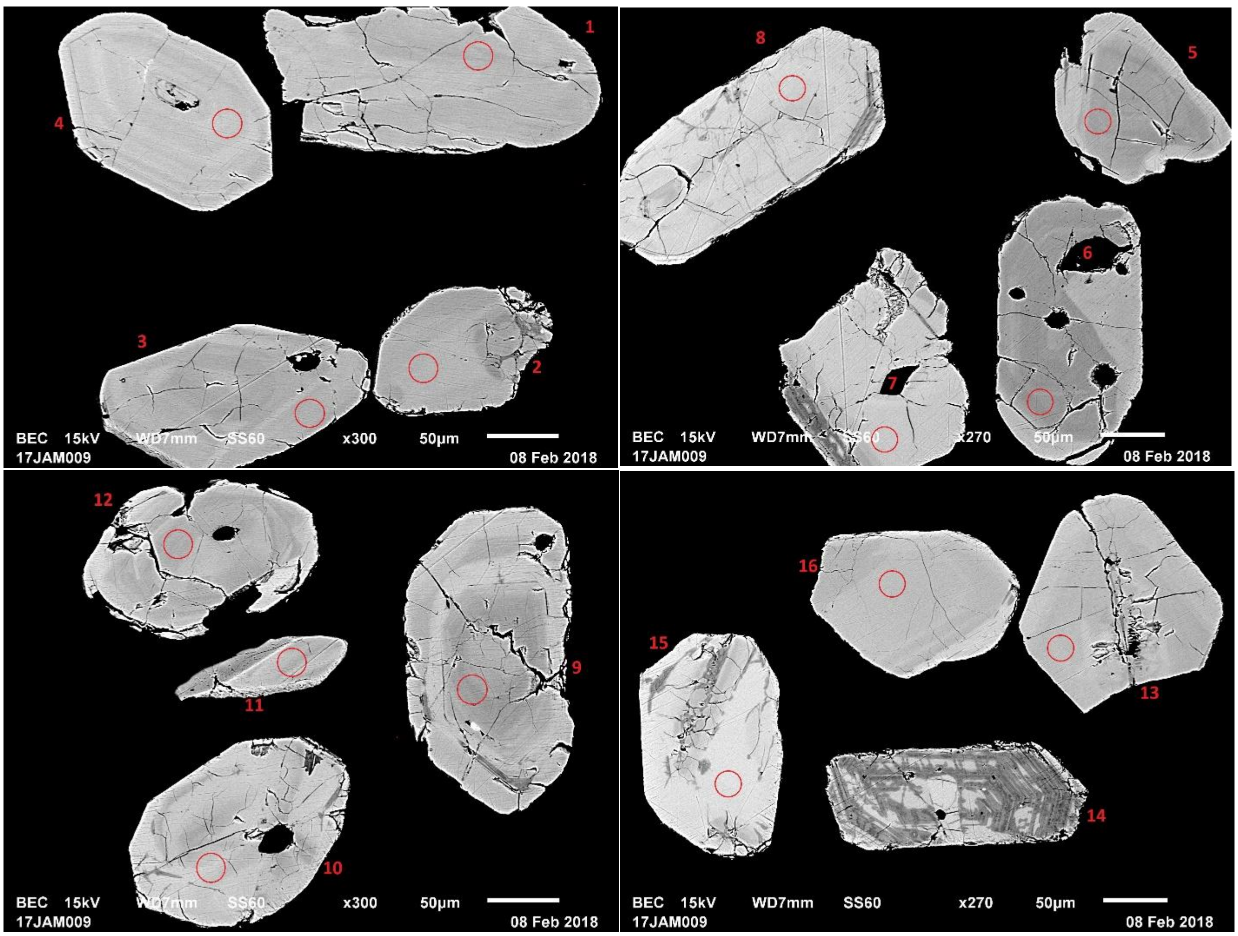


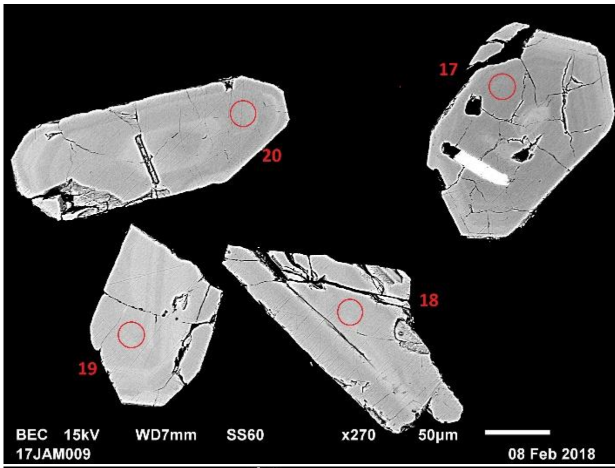

9
12
11
10
BEC 15kV WD7mm SS60 x200 100µm
17JAM-009DWD
07 Feb 2018
16
13
15
14
BEC 15kV WD7mm SS60 x200 100µm
17JAM-009DWD
07 Feb 2018
17
20
19
18
BEC SS60 x200 100µm
07 Feb 2018
21
24
23
22
BEC 15kV SS60 x230 100µm
07 Feb 2018
21
24
1
2
6
5
3
4
1
2
6
5
3
4
23
22
BEC 15kV SS60 x230 100µm
07 Feb 2018
28
25
27
26
BEC 15kV SS60 x190 100µm
07 Feb 2018

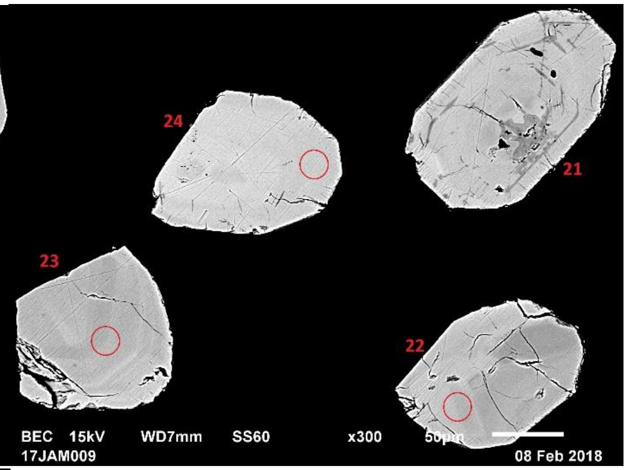

32
29
31
30
BEC 15kV WD7mm SS60
100µm
17JAM-009DWD
07 Feb 2018
36
33
34
35
BEC 15kV SS60 x220
17JAM-009DWD
07 Feb 2018
40
37
38
39
BEC 15kV WD7mm x230 100µm
17JAM-009DWD
07 Feb 2018
44
41
43
42
SS60 x220 100µm
07 Feb 2018
48
45
47
46
BEC SS60 100µm
52
49
51
50
BEC 15kV WD7mm SS60 x220 100µm
17JAM-009DWD
07 Feb 2018

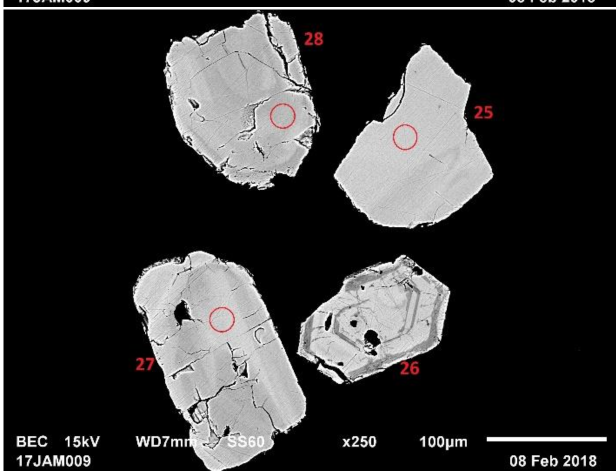


M180129B - 17JAM009

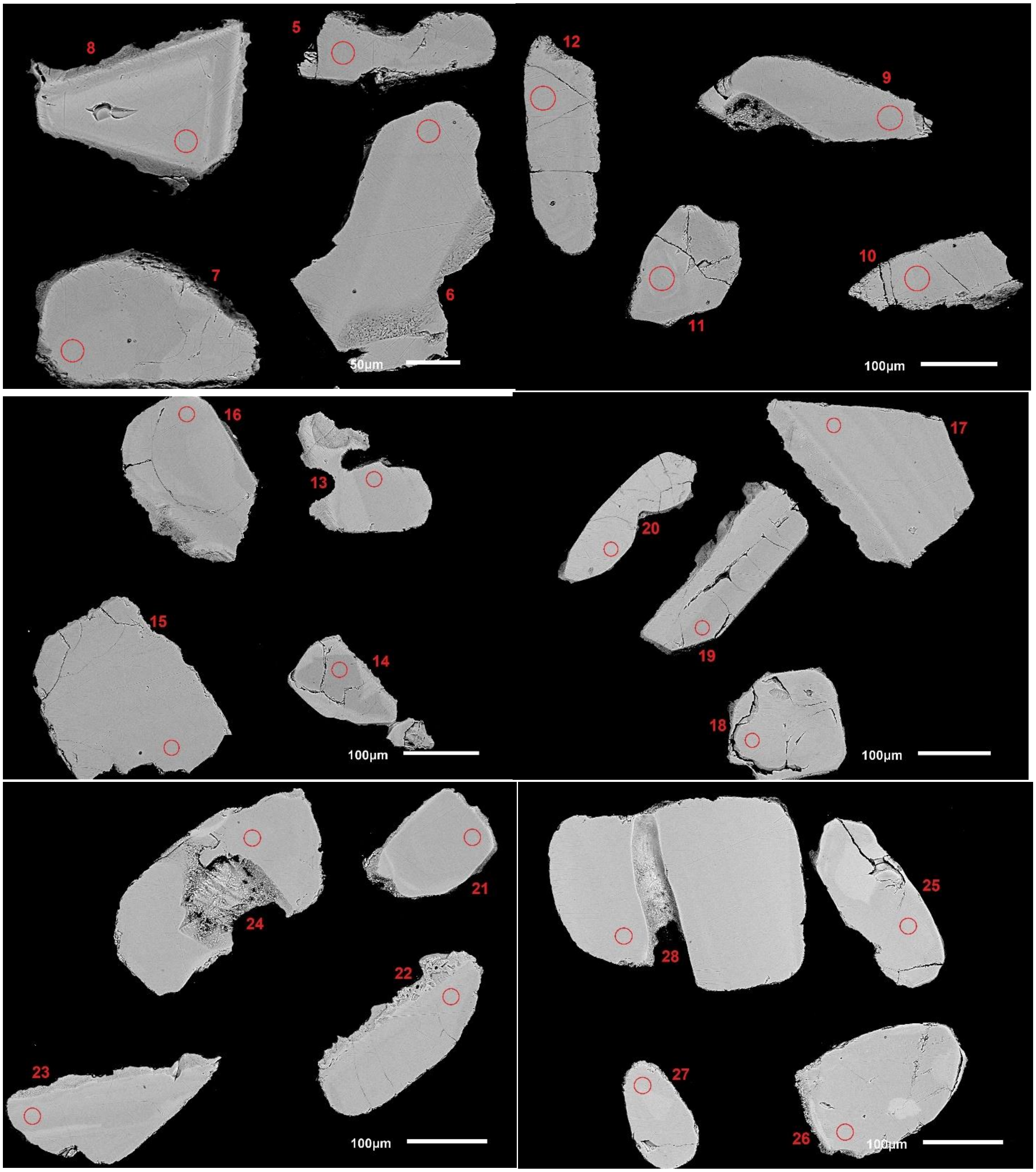


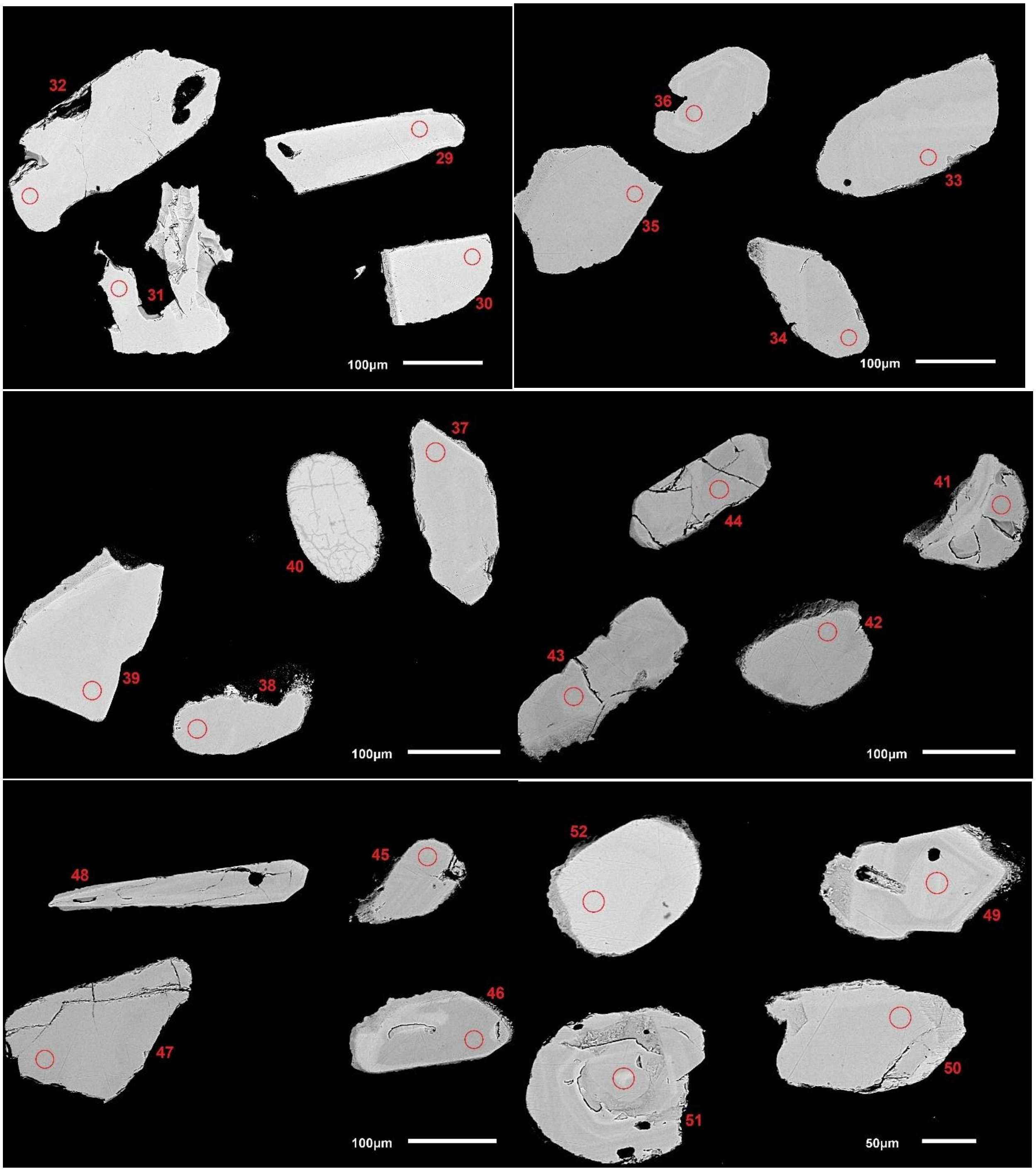






17JAM011 – M180305


8
5
12
9
6
7
11
10
50µm
100µm
16
13
17
20
19
15
14
18
100µm
100µm
24
21
25
28
22
23
27
26
100µm
100µm


32
29
31
30
100µm
36
33
35
34
100µm
37
40
39
38
100µm
44
41
43
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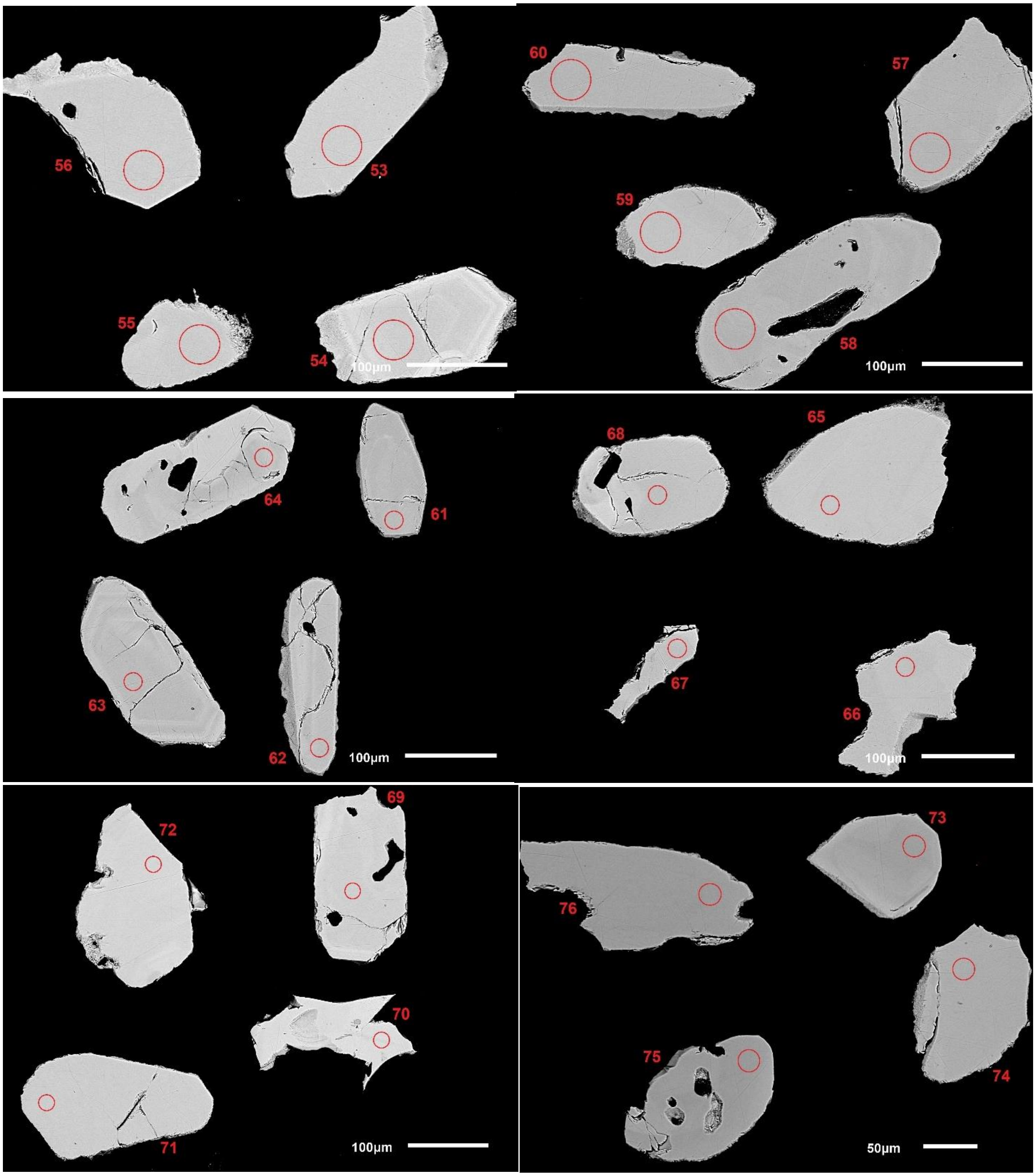
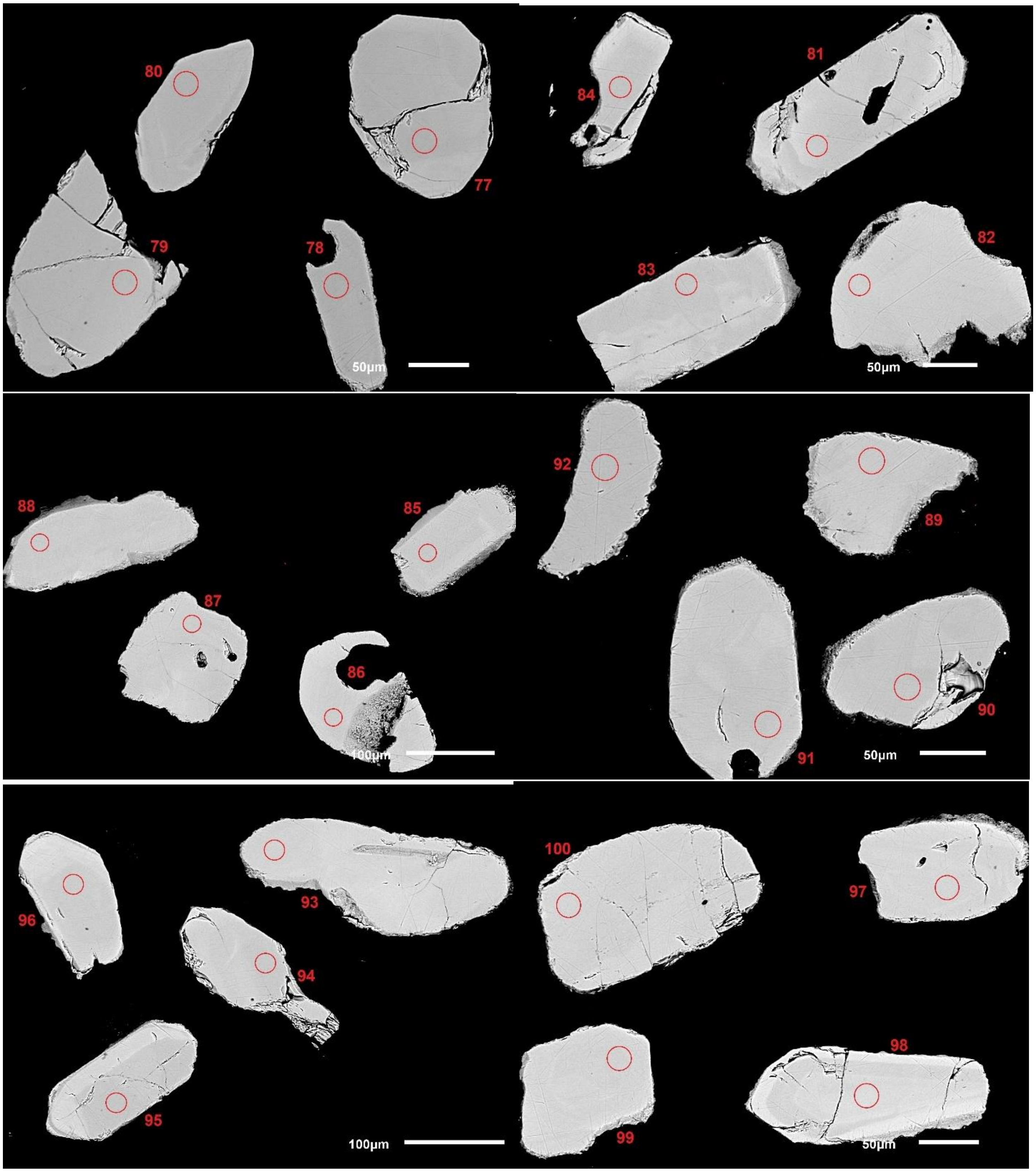
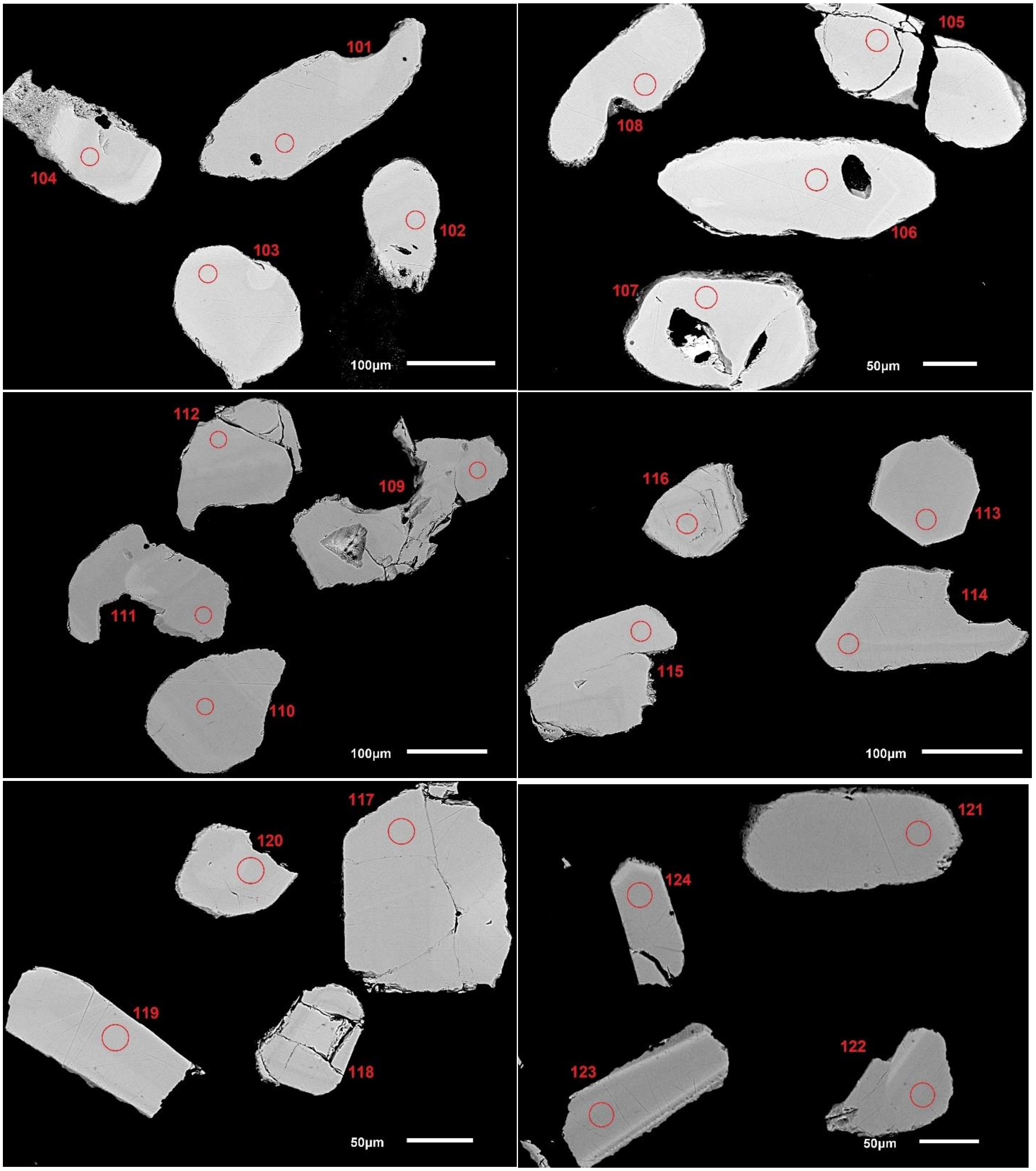
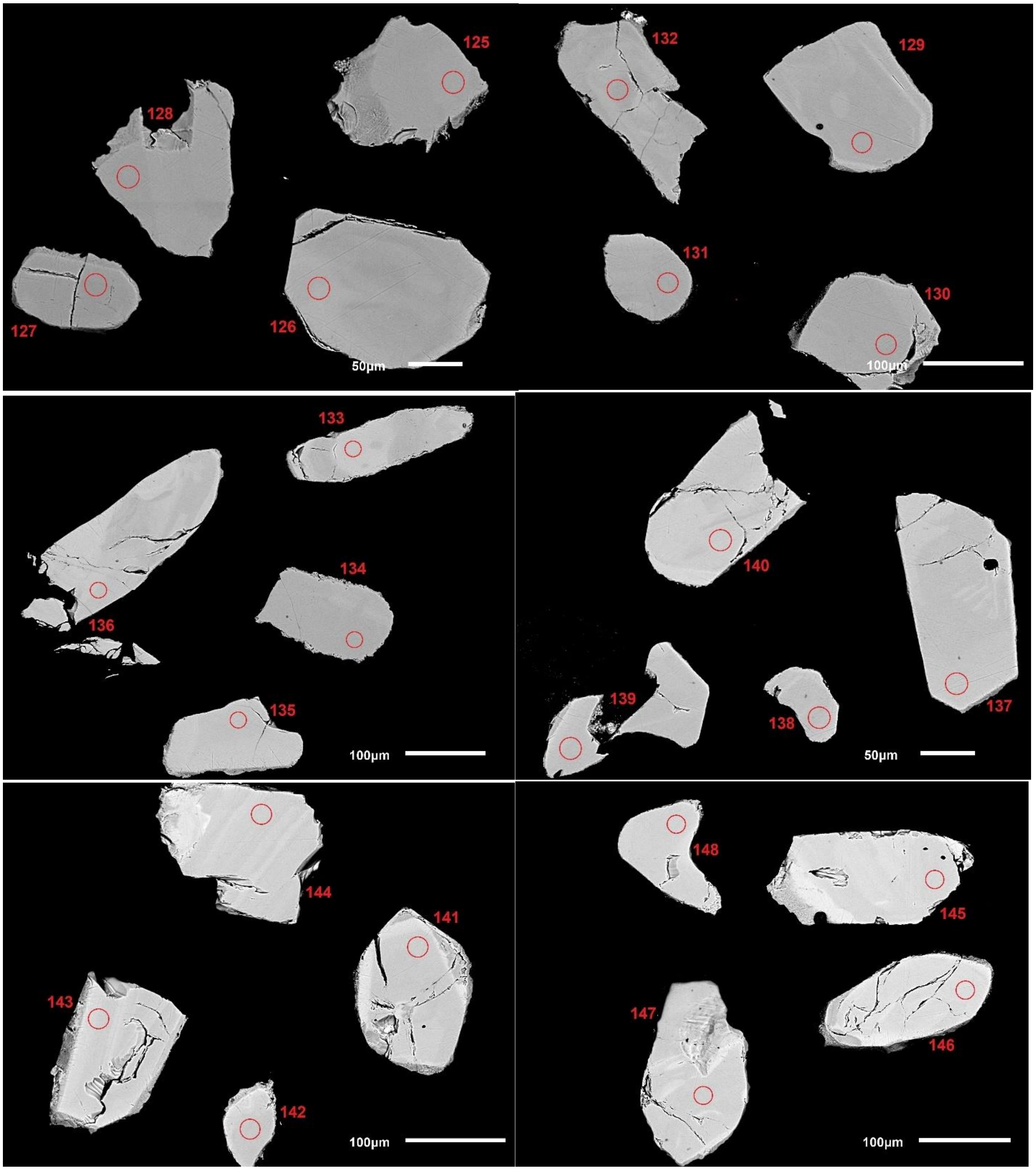
100µm
48
45
47
46
100µm
52
49
51
50
50µm


56
53
55
54
100µm
60
57
59
58
100µm
64
61
63
62
100µm
68
65
67
66
100µm
72
69
70
71
100µm
73
76
74
75
50µm

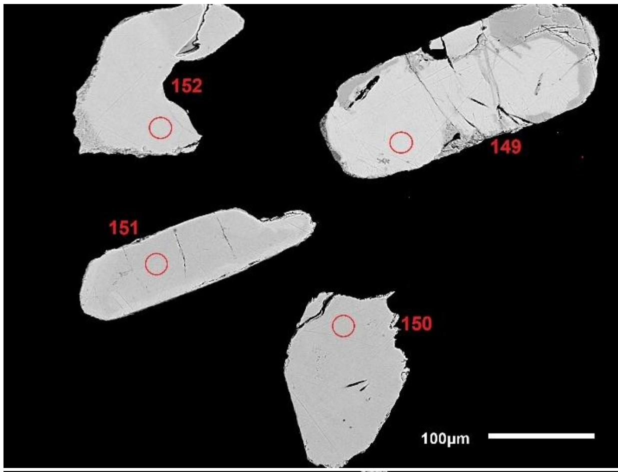


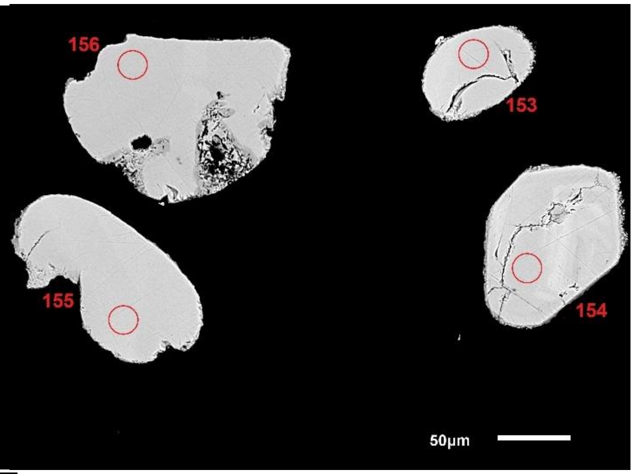
80
77
84
81
79
78
83
82
50µm
50µm
88
85
92
89
87
86
100µm
91
90
50µm
96
93
100
97
94
95
100µm
99
98
50µm

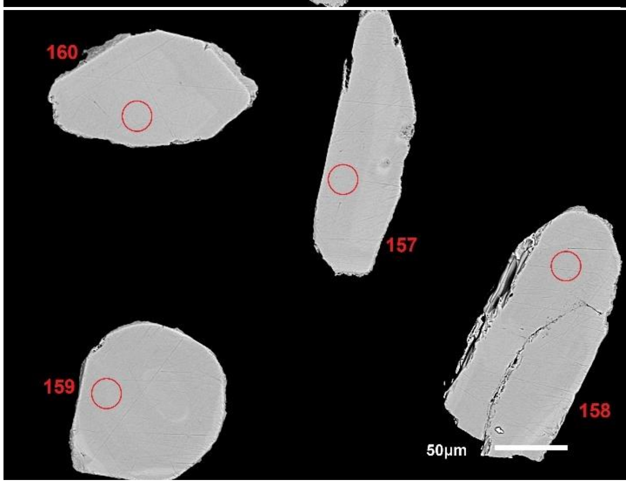

101
104
102
103
100µm
105
108
106
107
50µm
112
109
111
110
100µm
116
113
114
115
100µm
117
120
119
118
50µm
121
124
123
122
50µm



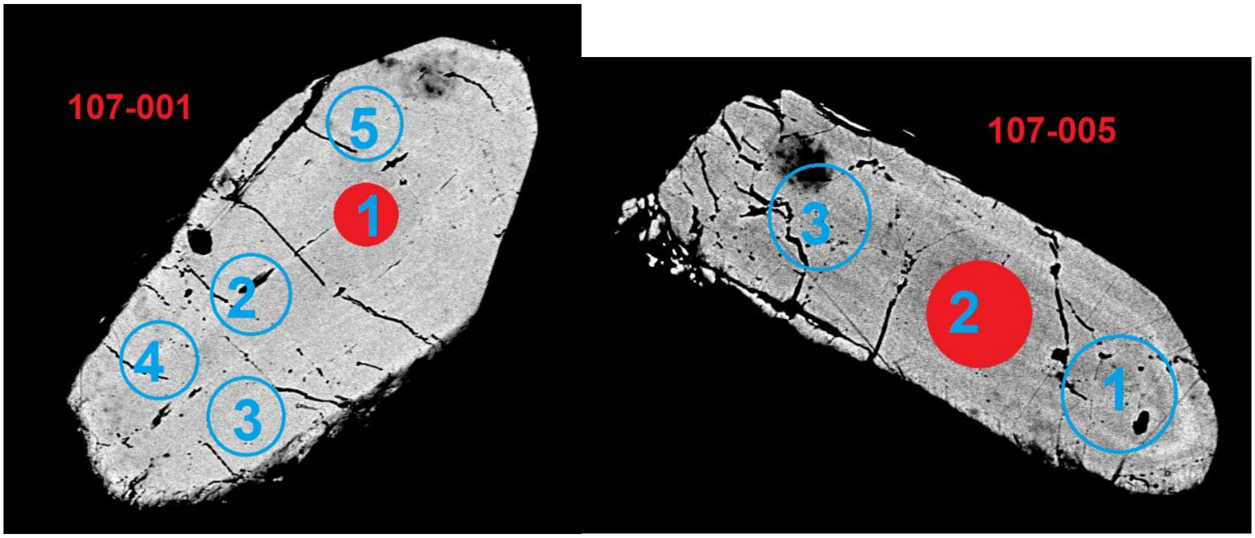
125
128
127
126
50µm
132
129
131
130
100µm
133
136
134
135
100µm
140
137
139
138
50µm
144
141
143
142
100µm
148
145
147
146
100µm

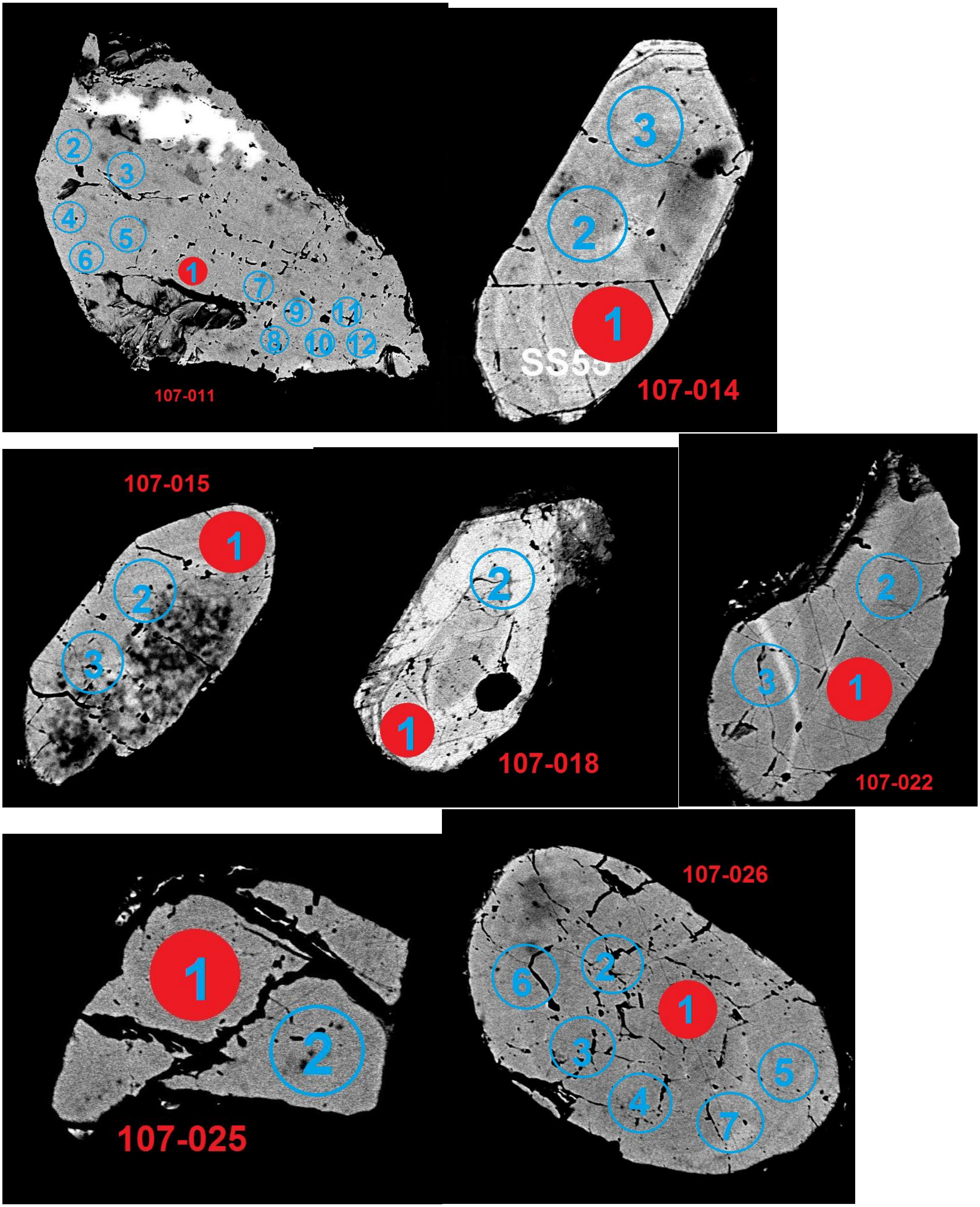

152
149
151
150
100µm

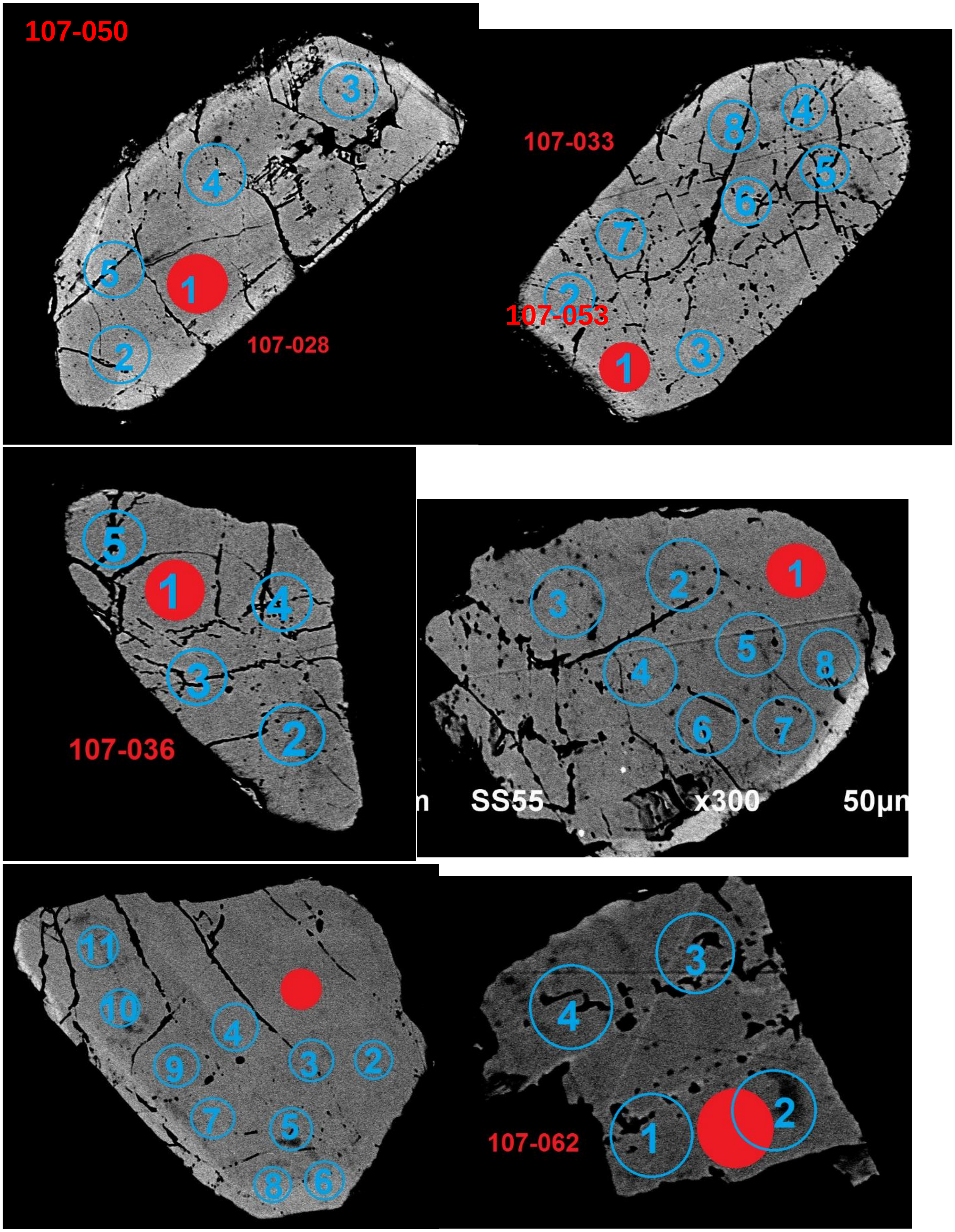

156
153
155
154
50µm


160
157
159
158
50µm

16CG107 – Reanalyzed spots




107-011
107-014
107-015
107-018
107-022
107-025
107-026

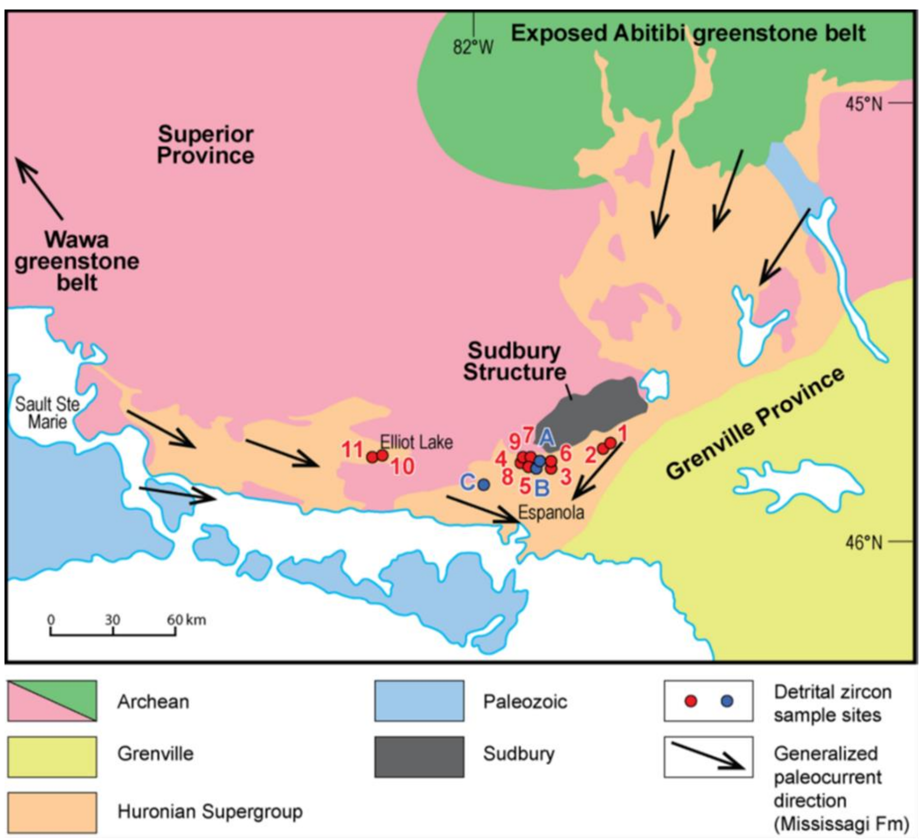

107-050
107-028
107-033
107-053
107-036
SS55
x300
50µm
107-062

Appendix C
Additional Data, Concordia Plots, PDDD and Images

GPS locations of all samples

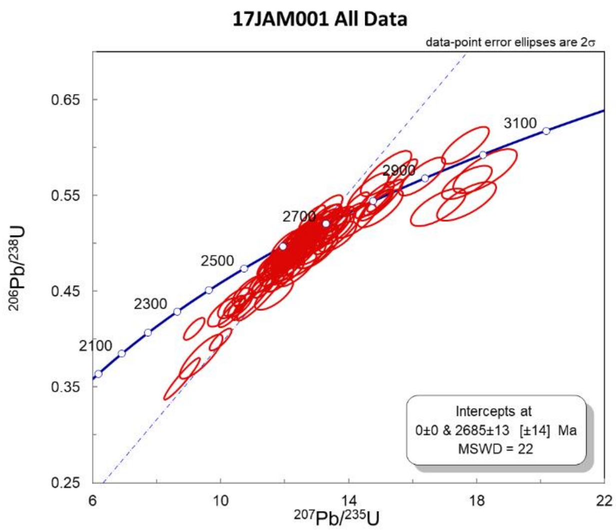
	UTM, NAD 83, Zone 17		Decimal Degrees		Degrees, Minutes, Seconds	
Sample	Easting	Northing	Latitude	Longitude	Latitude	Longitude
16CG106	464692	5139393	46.407188	-81.459367	46° 24' 25.8768" N	81° 27' 33.7212" W
16CG107	465844	5137013	46.385829	-81.444206	46° 23' 8.9844" N	81° 26' 39.1416" W
16CG108	446338	5126973	46.294210	-81.696721	46° 17' 39.156" N	81° 41' 48.1956" W
17JAM001	497322	5144924	46.457882	-81.034874	46° 27' 28.3752" N	81° 2' 5.5464" W
17JAM002	493464	5144352	46.452708	-81.085106	46° 27' 9.7488" N	81° 5' 6.3816" W
17JAM003*	471382	5136237	46.379102	-81.372137	46° 22' 44.7672" N	81° 22' 19.6932" W
17JAM004*	458619	5137442	46.389286	-81.538202	46° 23' 21.4296" N	81° 32' 17.5272" W
17JAM005	463006	5135277	46.370056	-81.480976	46° 22' 12.2016" N	81° 28' 51.5136" W
17JAM006*	471008	5138425	46.398777	-81.377136	46° 23' 55.5972" N	81° 22' 37.6896" W
17JAM007*	464712	5139391	46.407171	-81.459107	46° 24' 25.8156" N	81° 27' 32.7852" W
17JAM008*	464271	5137109	46.386611	-81.464670	46° 23' 11.7996" N	81° 27' 52.812" W
17JAM009	457868	5140950	46.420809	-81.548286	46° 25' 14.9124" N	81° 32' 53.8296" W
17JAM010	384388	5138637	46.391420	-82.503718	46° 23' 29.112" N	82° 30' 13.3848" W
17JAM011	371708	5140408	46.405064	-82.669060	46° 24' 18.2304" N	82° 40' 8.616" W

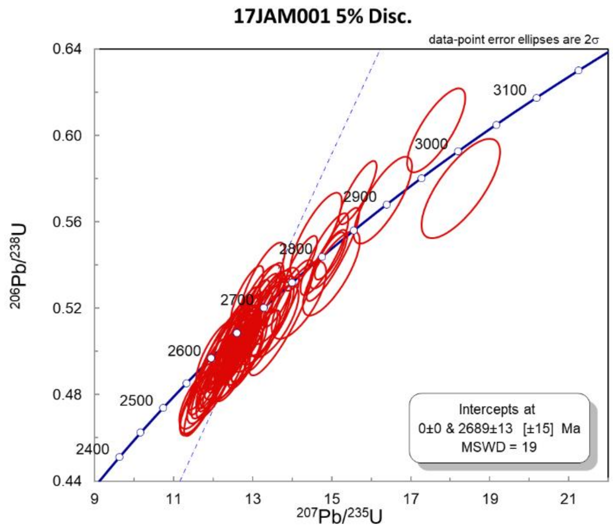
*Samples 17JAM 003, 004, 006, 007 & 008 were not analyzed for U/Pb ages.

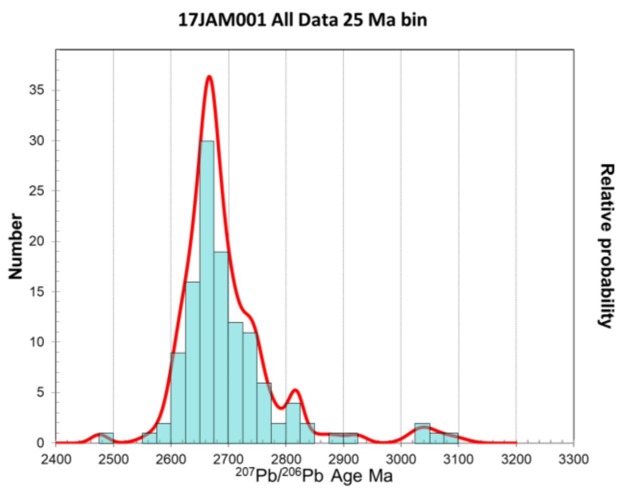


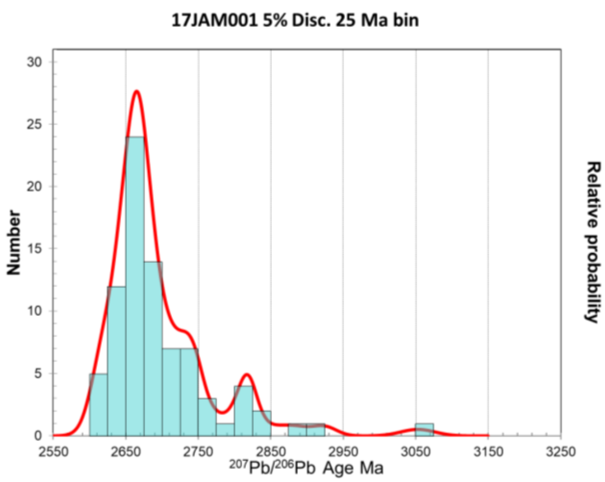
Map of all sample locations

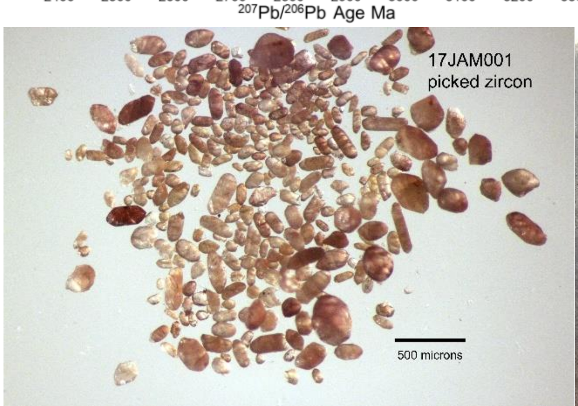
17JAM001


17JAM001 All Data
data-point error ellipses are 2σ
Intercepts at
0±0 & 2685±13 [±14] Ma
MSWD = 22
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$
2100
2300
2500
2700
2900
3100


17JAM001 5% Disc.
data-point error ellipses are 2σ
Intercepts at
0±0 & 2689±13 [±15] Ma
MSWD = 19
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$
2400
2500
2600
2700
2800
2900
3000
3100

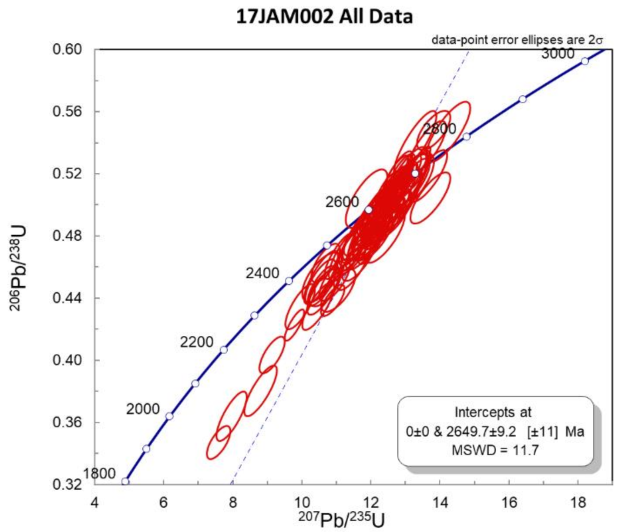

17JAM001 All Data 25 Ma bin
Number
Relative probability
$^{207}Pb/^{206}Pb$ Age Ma

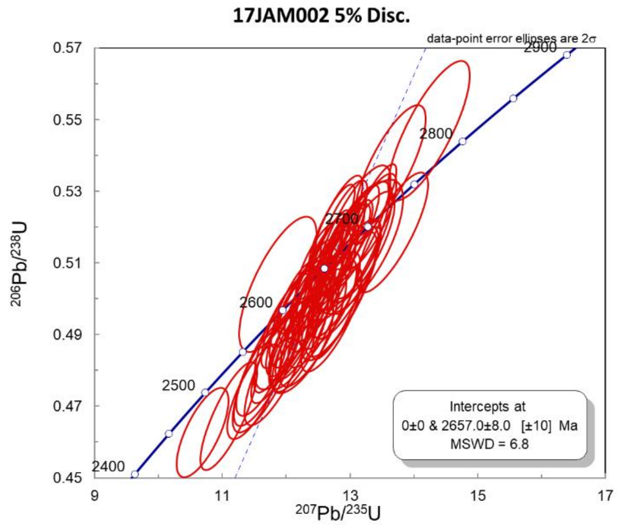

17JAM001 5% Disc. 25 Ma bin
Number
Relative probability
$^{207}Pb/^{206}Pb$ Age Ma

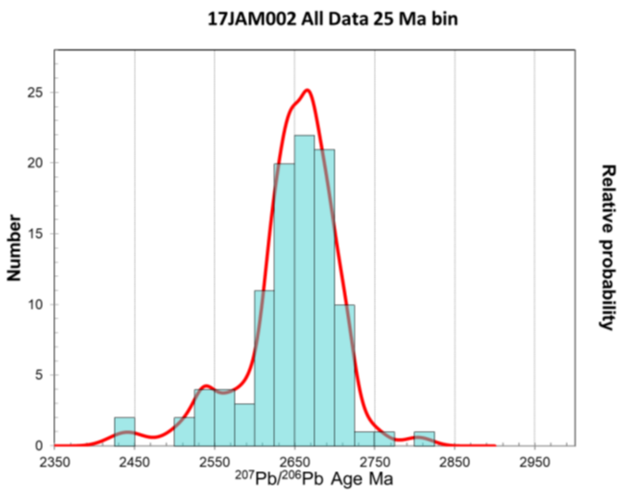

17JAM001
picked zircon
500 microns

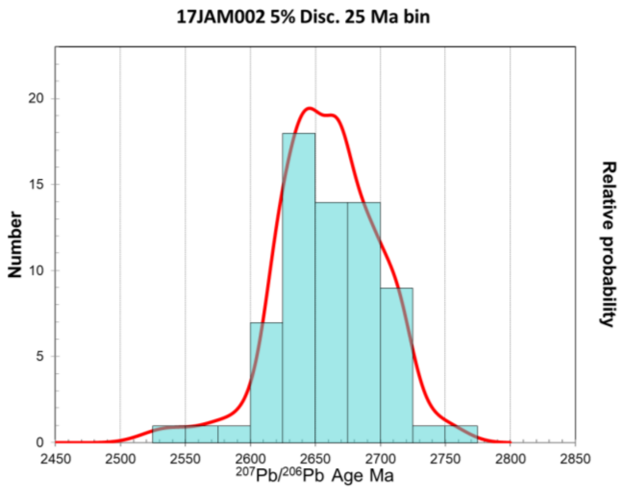

Ramsay Lake Fm.
McKim Twp.
17JAM001

17JAM002


17JAM002 All Data
data-point error ellipses are 2σ
1800
2000
2200
2400
2600
2800
3000
Intercepts at
0±0 & 2649.7±9.2 [±11] Ma
MSWD = 11.7
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$


17JAM002 5% Disc.
data-point error ellipses are 2σ
2400
2500
2600
2700
2800
2900
Intercepts at
0±0 & 2657.0±8.0 [±10] Ma
MSWD = 6.8
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$

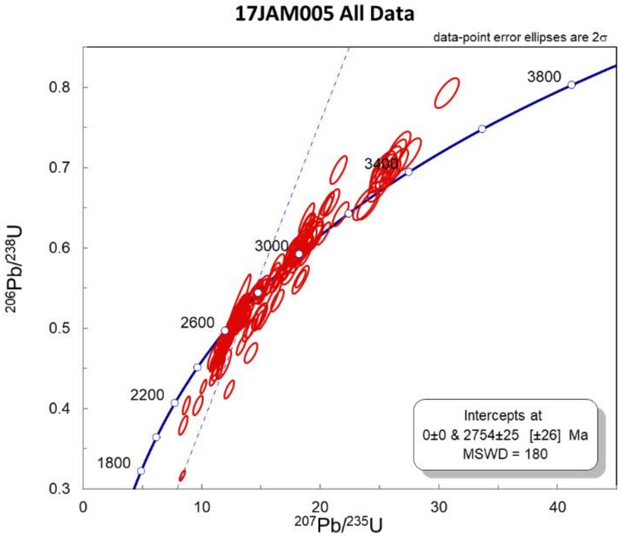

17JAM002 All Data 25 Ma bin
Number
Relative probability
$^{207}Pb/^{206}Pb$ Age Ma

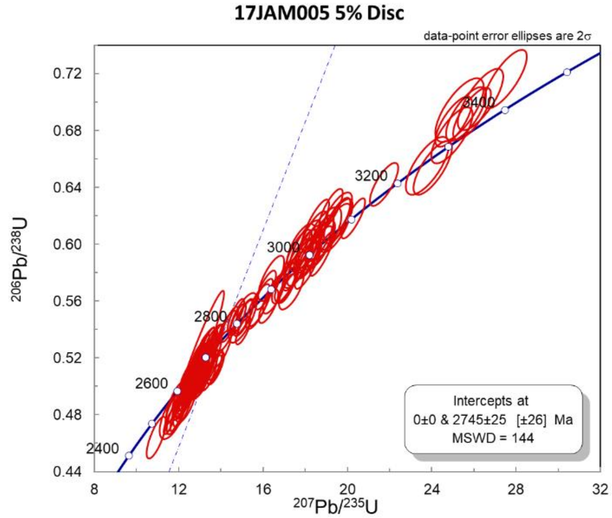

17JAM002 5% Disc. 25 Ma bin
Number
Relative probability
$^{207}Pb/^{206}Pb$ Age Ma

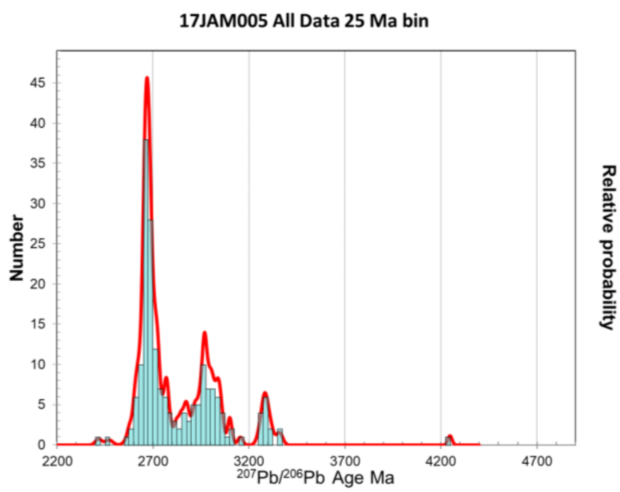

17JAM002 (x4)
Picked zircons
500 microns

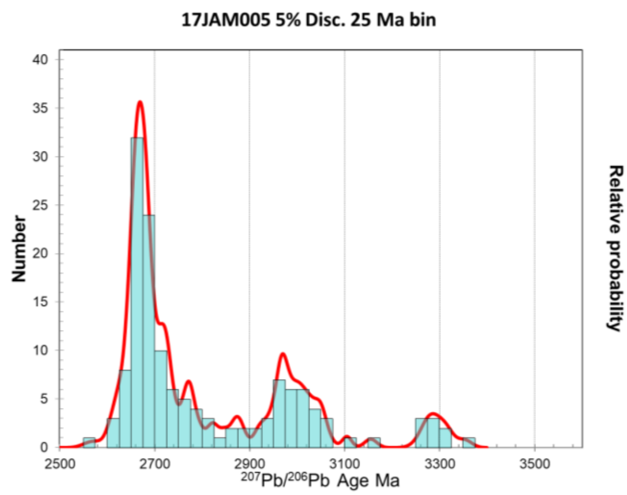

McKim Fm.
McKim Twp.
17JAM002

17JAM005


17JAM005 All Data
data-point error ellipses are 2σ
Intercepts at
0±0 & 2754±25 [±26] Ma
MSWD = 180
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$
1800
2200
2600
3000
3400
3800


17JAM005 5% Disc
data-point error ellipses are 2σ
Intercepts at
0±0 & 2745±25 [±26] Ma
MSWD = 144
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$
2400
2600
2800
3000
3200
3400

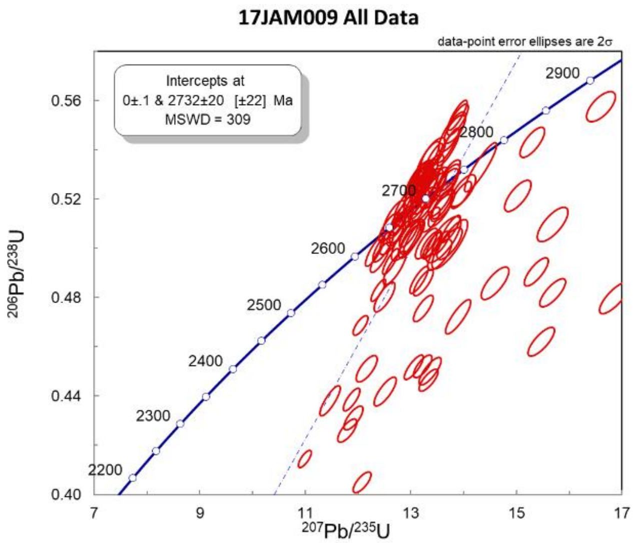

17JAM005 All Data 25 Ma bin
Number
Relative probability
$^{207}Pb/^{206}Pb$ Age Ma

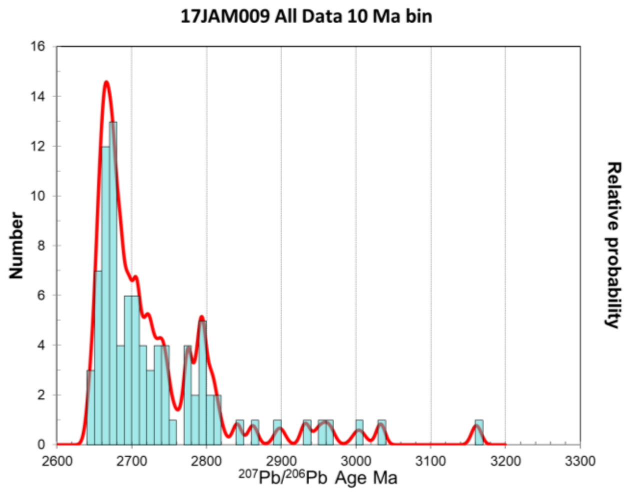

17JAM005 5% Disc. 25 Ma bin
Number
Relative probability
$^{207}Pb/^{206}Pb$ Age Ma

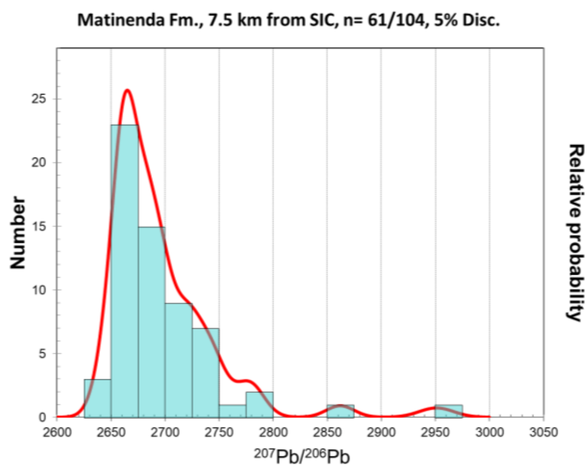

17JAM005 (x4)
Picked zircon
400 microns


Mississagi Fm.
Drury Twp.
17JAM005

17JAM009


17JAM009 All Data
data-point error ellipses are 2σ
Intercepts at
0±.1 & 2732±20 [±22] Ma
MSWD = 309
2900
2800
2700
2600
2500
2400
2300
2200
0.56
0.52
0.48
0.44
0.40
7
9
11
13
15
17
206Pb/238U
207Pb/235U

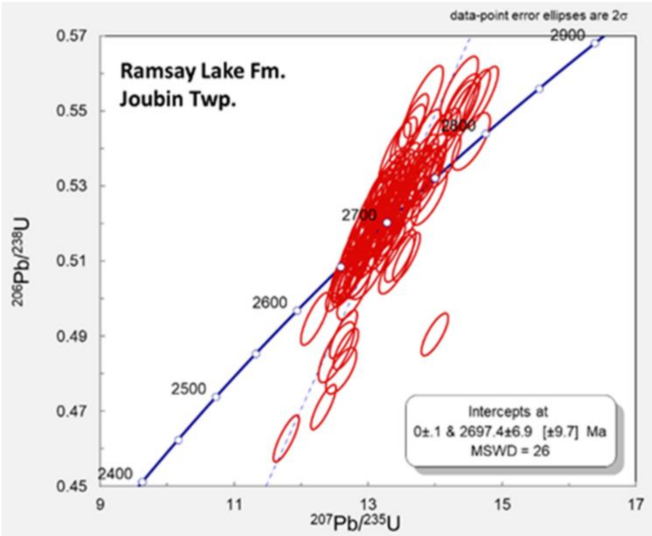

17JAM009 All Data 10 Ma bin
Number
Relative probability
207Pb/206Pb Age Ma
2600
2700
2800
2900
3000
3100
3200
3300

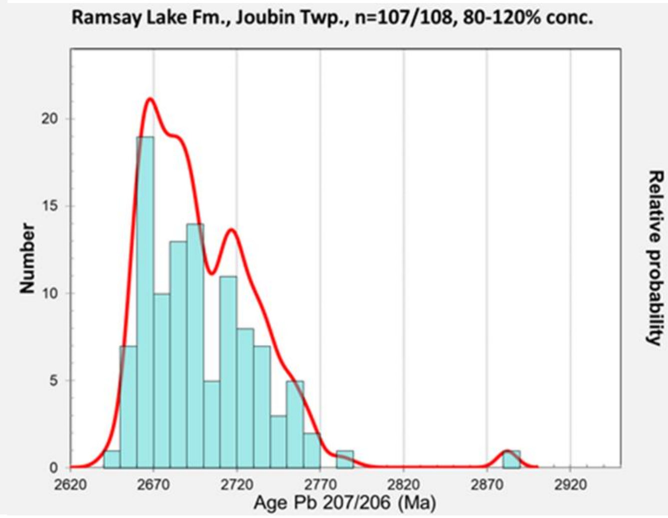

Matinenda Fm., 7.5 km from SIC, n= 61/104, 5% Disc.
Number
Relative probability
207Pb/206Pb

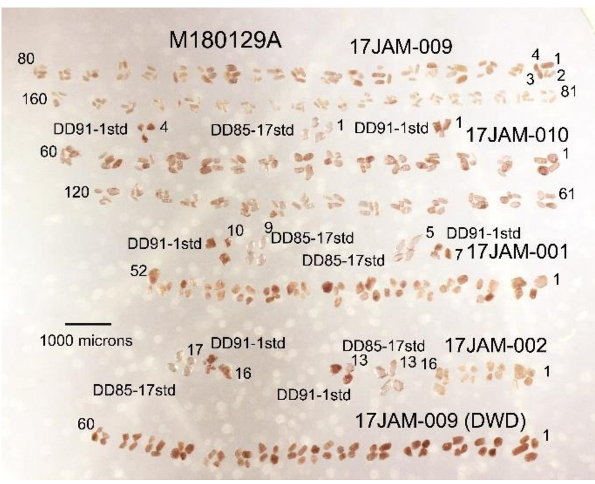

17JAM-009
picked zircon
400 microns


Matinenda Fm.
Drury Twp.
17JAM009

17JAM010

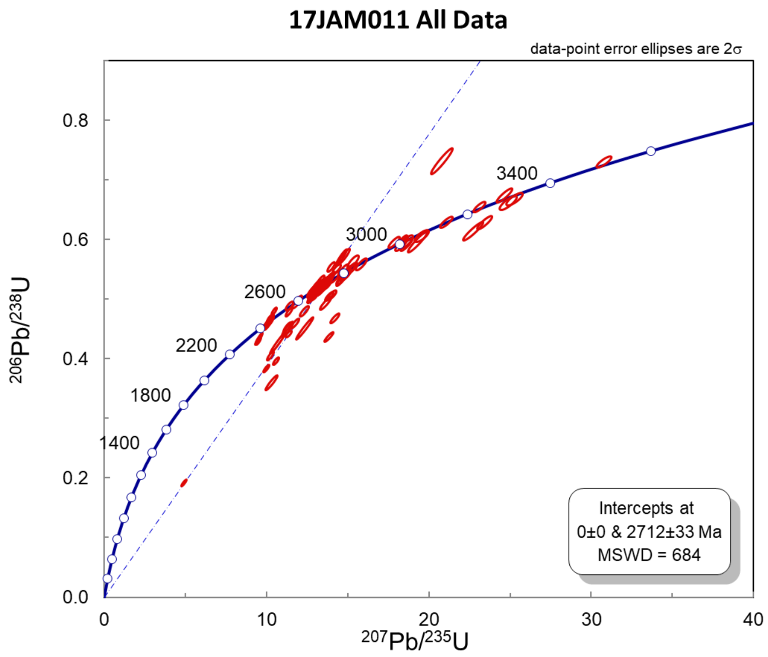

data-point error ellipses are 2σ
Ramsay Lake Fm.
Joubin Twp.
2400
2500
2600
2700
2800
2900
Intercepts at
0±.1 & 2697.4±6.9 [±9.7] Ma
MSWD = 26
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$

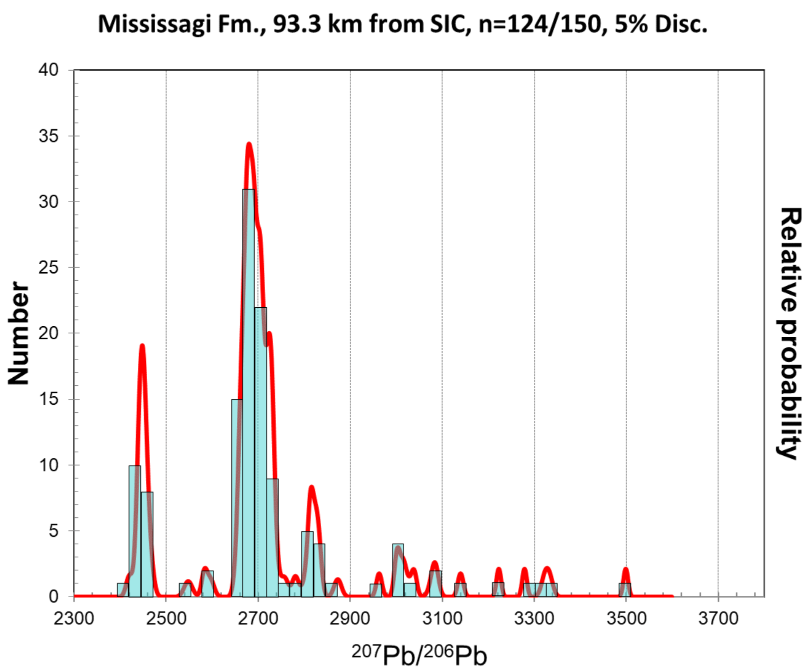

Ramsay Lake Fm., Joubin Twp., n=107/108, 80-120% conc.
Number
Relative probability
Age Pb 207/206 (Ma)

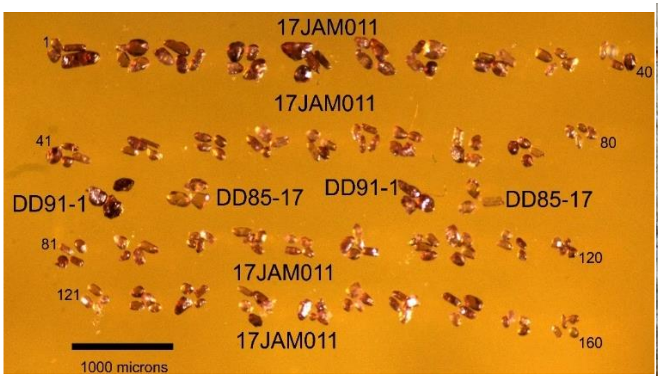

M180129A
17JAM-009
17JAM-010
17JAM-001
17JAM-002
17JAM-009 (DWD)
DD91-1std
DD85-17std
1000 microns


Ramsay Lake Fm.
Joubin Twp.
17JAM010

17JAM011

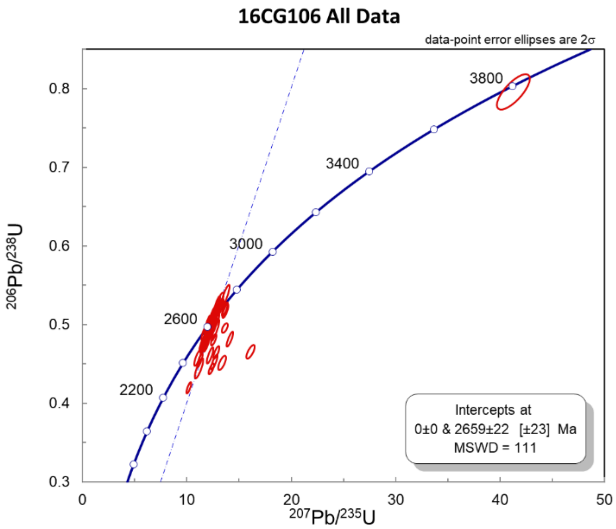

17JAM011 All Data
data-point error ellipses are 2σ
Intercepts at
0±0 & 2712±33 Ma
MSWD = 684
$^{206}Pb/^{238}U$
$^{207}Pb/^{235}U$
3400
3000
2600
2200
1800
1400

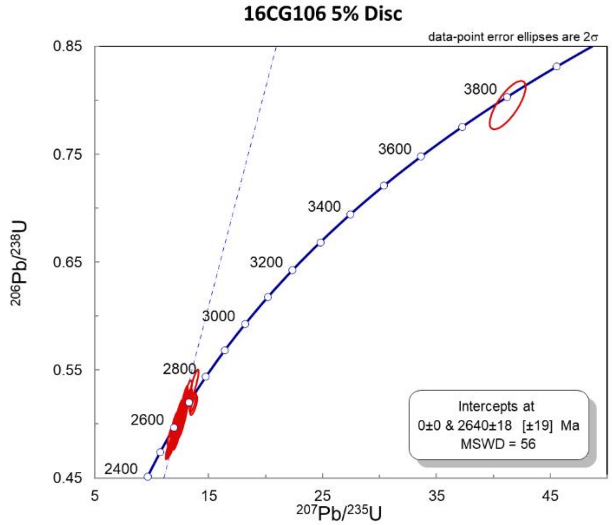

Mississagi Fm., 93.3 km from SIC, n=124/150, 5% Disc.
Number
Relative probability
$^{207}Pb/^{206}Pb$

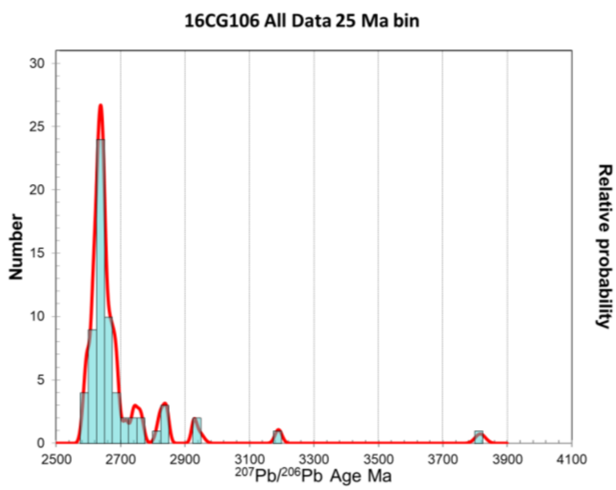

17JAM011
17JAM011
DD91-1
DD85-17
DD91-1
DD85-17
17JAM011
17JAM011
1000 microns

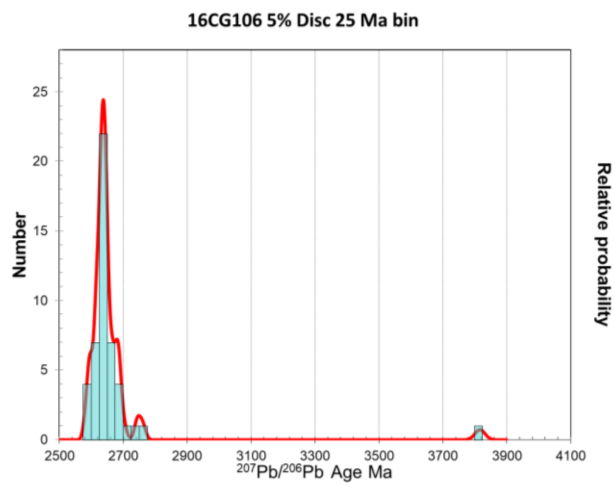

Mississagi Fm.
Gunterman Twp.
17JAM011

16CG106 (Menard, 2017)

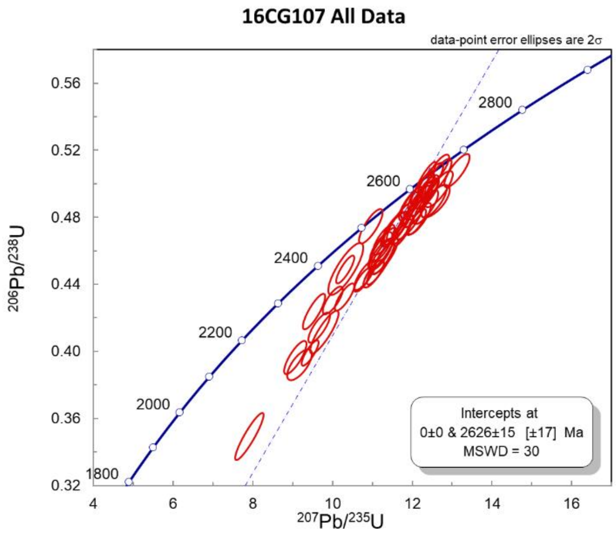


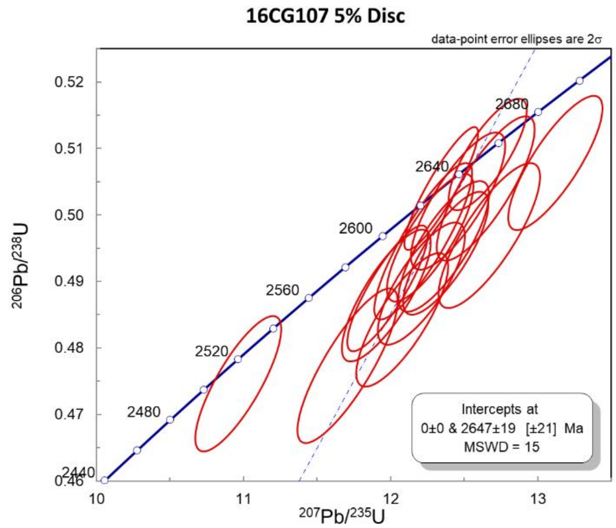


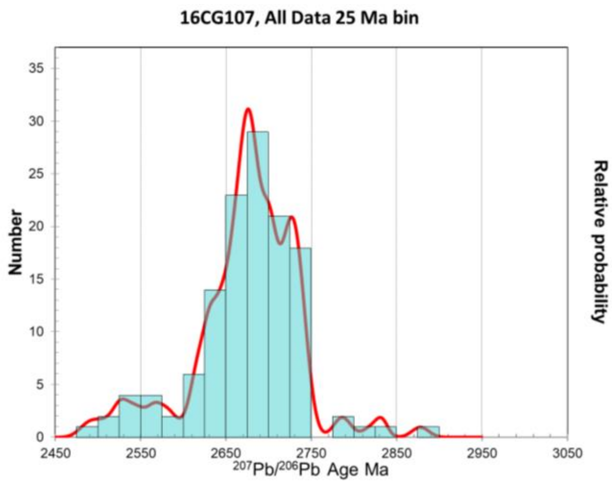


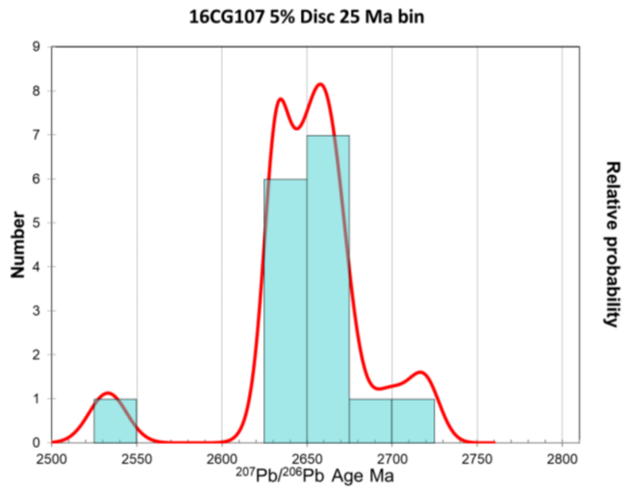


16CG107 (Menard, 2017)









16CG108 (Menard, 2017)